

Canadian Translation of Fisheries and Aquatic Sciences

No. 5220

Freshwater oligochaeta of Kamchatka and  
the Koryak upland

N.L. Sokol'skaya

Original title: Presnovodnyye maloshchetinkovyye chervi (Oligochaeta)  
Kamchatki i Koryakskogog nagor'ya

In: Sb. Tr. Zool. Muz. MGU 20: 22-119, 1983

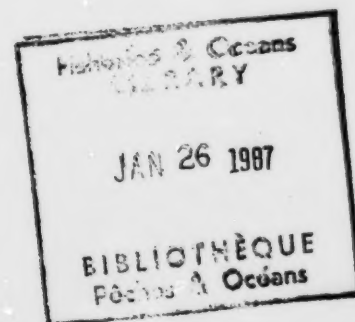
Original language: Russian

Available from:

Canada Institute for Scientific and Technical Information  
National Research Council  
Ottawa, Ontario, Canada K1A 0S2

1986

119 typescript pages





Secretary  
of State

Secrétariat  
d'État

90-02689/

MULTILINGUAL SERVICES DIVISION – DIVISION DES SERVICES MULTILINGUES

TRANSLATION BUREAU

BUREAU DES TRADUCTIONS

LIBRARY IDENTIFICATION – FICHE SIGNALÉTIQUE

CTFAS 5220

Translated from - Traduction de  
Russian  
Into - En  
English

Author - Auteur

N.L. Sokol'skaya

Title in English or French - Titre anglais ou français

Freshwater Oligochaeta of Kamchatka and the Koryak upland

Title in foreign language (Transliterate foreign characters)  
Titre en langue étrangère (Transcrire en caractères romains)

Presnovodnyye maloshchetinkovyye chervi (Oligochaeta) Kamchatki  
i Koryakskogog nagor'ya

Reference in foreign language (Name of book or publication) in full, transliterate foreign characters.  
Référence en langue étrangère (Nom du livre ou publication), au complet, transcrire en caractères romains.

Sbornik trudov Zoologicheskogo muzeya MGU

Reference in English or French - Référence en anglais ou français

Collection of Scientific Papers of the Zoological Museum of  
Moscow State University

| Publisher - Éditeur | DATE OF PUBLICATION<br>DATE DE PUBLICATION |        |                     | Page Numbers in original<br>Numéros des pages dans<br>l'original |
|---------------------|--------------------------------------------|--------|---------------------|------------------------------------------------------------------|
|                     | Year<br>Année                              | Volume | Issue No.<br>Numéro | Number of typed pages<br>Nombre de pages<br>dactylographiées     |
| not available       | 1983                                       | 20     | -                   | 22-119<br>119                                                    |

Requesting Department  
Ministère-Client D F O

Translation Bureau No.  
Notre dossier n° 2126554

Branch or Division  
Direction ou Division SIPB

Translator (Initials)  
Traducteur (Initiales) N. De.

Person requesting  
Demandé par R.O. Brinkhurst

Your Number  
Votre dossier n° ---

Date of Request  
Date de la demande January 28, 1986

UNEDITED TRANSLATION  
For information only  
TRADUCTION NON REVISEE  
Information seulement

Canada



## MULTILINGUAL SERVICES DIVISION – DIVISION DES SERVICES MULTILINGUES

## TRANSLATION BUREAU

## BUREAU DES TRADUCTIONS

|                                    |                                 |                                                          |                              |
|------------------------------------|---------------------------------|----------------------------------------------------------|------------------------------|
| Client's No.—N° du client          | Department — Ministère<br>D F O | Division/Branch — Division/Direction<br>SIPB             | City — Ville<br>Sidney, B.C. |
| Bureau No.—N° du bureau<br>2126554 | Language — Langue<br>Russian    | Translator (Initials) — Traducteur (Initiales)<br>N. De. | MAR 13 1986                  |

Sbornik trudov Zoologicheskogo muzeya MGU (Collection of Scientific Papers of the Zoological Museum of Moscow State University), 1983, v. 20, pp. 22-119

(22)\*

Freshwater Oligochaeta of Kamchatka and the Koryak upland

by N.L. Sokol'skaya

The first data on the oligochaete fauna of Kamchatka appeared in a paper by W. Michaelsen (1929) after the oligochaetes of the 1908-1909 Kamchatka expedition of the Ryabushinsky brothers had been examined. Michaelsen noted 12 species of oligochaetes on the peninsula; two of them were described as new species (Pachydrilus kamtschatkanus Mich. and Rhyacodrilus riabuschinskii Mich.). Since then, all the research on the oligochaetes of Kamchatka has been carried out in association with the Kamchatka branch of the Pacific Scientific Research Institute of Fisheries and Oceanography (TINRO) which has been involved in extensive hydrobiological collections of oligochaetes in the water bodies of the peninsula (begun in 1946 and greatly expanded in the 1960s), and with the Laboratory of Freshwater Hydrobiology and Ichthyology of the Soil Biology Institute of the Far Eastern Scientific Centre of the USSR Academy of Sciences (DVNTs AN SSSR, 1971-1972). The above-mentioned collections of I.I. Kurenkov, I.M. Levanidov, V.Ya. Levanidova, R.S. Semko, B. Vronsky, L.V. Kokhmentko, Ye.T. Nikolayeva and other researchers have been handed over on a regular

UNEDITED TRANSLATION  
For information only  
TRANSLATION NON REVISEE  
Information seulement

basis to the Zoological Museum of Moscow University and examined by us. It is my great pleasure to thank these scientists for their highly interesting material which consists of about 330 samples from 64 bodies of water (more than 10,000 specimens of worms).

As a result, we have data on 38 species of oligochaetes from Kamchatka; some of them have been described as new to science (Kurenkov, 1967; Sokol'skaya, 1961, 1964a,b, 1968a,b, 1969, 1971, 1972a,b, 1973a,b). The collections examined cover all the parts of Kamchatka and different types of water bodies (lakes, rivers and tributaries, springs, swamps, thermal waters, limans). In the northern part of the peninsula, specimens were collected in Lake Palana and the Palana and Tigil rivers in the west, and in the Kayum, Makar'yevskaya and Uka river basins in the east. A thorough study was also carried out in the Kamchatka R. basin with its numerous lakes, rivers and springs (lakes Ushkovskoye, Eul'chinok, Beloye, Dvukhyurtochnoye, Kharchinskoye (and its springs), Klyuchevskoye, Sobach'ye, Kurarochnoye (and the Bol'shoi Kurarochnyi spring), Kenuzhen, Kamenskoye, Grob, Fil'kino, Katlanach, Prigorodnyi spring, Roshchiki R., Lake Azabach'ye, Ponomarskaya R., lakes Nerpich'ye and Soldatskoye and Soldatskaya R.). In the western half of the central part of the peninsula, investigations were conducted in the water bodies of the Khairyuzovaya, Icha and Oblukovina river basins, and in the eastern sector a thorough study was carried out in Lake Kronotskoye and the water bodies of the Uzon caldera. On the eastern coast of Kamchatka, specimens were collected in the Zhupanova R. basin and in the

(23)

Zhupanovsky liman. In the southern part of the peninsula, oligochaetes were collected in the Nachikinskoye, Tolmachevskoye, Zuikovski and Kurile lakes, as well as in the rivers Avach with its tributary Krutaya Pad', Bystraya (with hot bathing springs in its upper part), Karymshina, Plotnikov, Dal'nyaya, Bol'shaya (and its tributary Karymai), Utka (with the Domashniy and Lis'iy springs), and in the Kikhchik R. basin.

In the Kamchatka material examined by us, we did not encounter any of the species found in Kamchatka by Michaelsen (1929), i.e. Nais communis Piguet, Homochaeta naidina Bretscher, Lumbricillus kamtschatkanus (Michaelsen) and Spirosperma (S.) ferox Eisen. The absence of the first two species can easily be attributed to the difficulty of collecting these small worms. Immature enchytraeids with "Lumbricillus-type" setae were encountered repeatedly, and one can assume that they belong to Michaelsen's species. S. ferox is apparently not found in the water bodies of Kamchatka.

Having examined the Zoological Institute's Kamchatka specimens which have been identified as S. ferox by Michaelsen (Lake Kurile - Nos. 38, 39, 40, 43; Tarkhovka R. - Nos. 44 and 45, Lake Kursin - Nos. 41 and 42, Lake Azabach'ye - No. 45), we are convinced that they belong to other species of Spirosperma which were encountered later in Kamchatka (Sokol'skaya, 1961), mostly S. (E.) kurenkovi (Sokolskaja). Michaelsen also notes two more occurrences of S. ferox on the peninsula, Lake Glubokoye and Lake Krestovoye. These specimens are not in the Zoological Institute's collection, and we have not had the opportunity to check them. We assume that if this species existed in Kamchatka, we would have inevitably

encountered it in our extensive collection. We should mention that we did come across S. (O.) nikolskyi (Lastochkin et Sokol'skaja) which is similar in its external characters to S. (S.) ferox, and it has been reliably identified from mature specimens. We have reduced Michaelsen's Rhyacodrilus riabuschinskii to a synonym of Rh. coccineus (Vejdovsky) (Sokol'skaya, 1968b). (24)

Until very recently, the parts of the mainland bordering on Kamchatka had been unresearched as to oligochaetes. I.I. Kurenkov's collection (TINRO) from the water bodies of the Koryak upland and the material of the Laboratory of Freshwater Hydrobiology and Ichthyology of the Soil Biology Institute of DVNTs AN SSSR, which was collected in the same area and in the Penzhina R. basin (lower part), helped fill in the gap. The collections covered a number of lakes (Potatgytkhyn, Ilirgytkhyn (Kultuchnoye) and Khaigytikhyn), as well as water bodies in the basins of the rivers Vyvenka and Pakhacha, Maino-Pyl'gen (Pylgovayam R., etc.). More than 20 water bodies were studied in all (approximately 1500 specimens of worms). Of the 15 species found in this region, the following are not known as yet in Kamchatka: Nais simplex Piguet (family Naididae), Rhyacodrilus svetlovi Sokolskaja and Ilyodriloides potatiensis, gen. et sp. n. (family Tubificidae), as well as three species of Lumbriculidae, Stylodrilus (Bythonomus) chukotensis Sok., Rhynchelmoides malevici, sp. n. and Styloscolex (Styloscolex) tetrathecus Burow.

Among these species, only the first is represented by small worms; the rest are quite noticeable and sometimes very large worms which could not have gone unnoticed in Kamchatka, a region better researched than the adjacent parts of the Koryak upland.

The following can be said about the completeness of the species composition of the Oligochaeta. The group of Naididae (15 species) will definitely be expanded with further research of the fauna. This family includes very small worms, the collection and sampling of which involve tedious and time-consuming work that requires a certain skill. One can expect a particularly greater number of Naididae species for the Koryak upland where only three species have been noted so far. The number of Tubificidae species in Kamchatka (12) is quite close to the actual one, as in the case of the Lumbriculidae. At the same time, we should note that these families include fairly small worms, which is an indication that the collections have been quite thorough.

Before passing over to the systematic portion of this paper, we must touch on some of the questions of the Oligochaeta taxonomy. We agree with O.V. Chekanovskaya's (1962) division of this class into two orders, Naidomorpha and Lumbricomorpha. Brinkhurst and Jamieson's (1971) division of the subclass Oligochaeta into three orders, Lumbriculida, Moniligastrida and Haplotaxida, does not appear conclusive to us. The first two apparently represent natural groups with a definite set of features. The order Haplotaxida has been formed artificially on the basis of a single characteristic, i.e. the presence of sperm funnels at least one segment in front of the male pores, and includes all the diversity of the forms from the Naididae to the earth worms. The order cannot be compared with any other order as to the range of the differences of the taxa included in it. The authors' division of the Haplotaxida into three suborders, i.e. Haplotaxina (with

(25)

one family Haplotaxidae), Tubificina (with two superfamilies Enchytraeioidea and Tubificoidea) and Lumbricina (with two superfamilies Alluroidea and Lumbricoidea), does not help matters. We are also against Brinkhurst and Jamieson's exclusion of Aeolosomatidae and Branchiobdellidae from the Oligochaeta (in the second case even without discussing the matter).

The positive aspect of the system proposed by these authors is that they set off the Enchytraeidae from the rest of the Tubificina in a separate superfamily, which is in line with the morphological originality of this numerous and possibly heterogeneous group of oligochaetes.

The question regarding the classification of the family Tubificidae and the system adopted in this cases requires some discussion. As a basis, we are adopting S.A. Hrabe's (1954, 1963, 1964, 1966, 1967) division of the family into 5 subfamilies, i.e. Rhyacodrilinae, Tubificinae, Telmatodrilinae, Branchiurinae and Aulodrilinae. In agreement with this structure as a whole, O.V. Chekanovskaya (1972) is against singling out Telmatodrilinae, as she does not believe that the presence of numerous prostatic glands falling into the atria is sufficient for establishing a separate subfamily. We believe that this character is important enough for establishing a subfamily. O.V. Chekanovskaya suggests that yet another subfamily be established, Bothrioneurinae (genus Bothrioneurum Stolc.); we cannot help but agree with her, as the originality of Bothrioneurum is unquestionable and concerns not only the characteristics of the reproductive system, but also the morphological characters not related to it. The family Tubificidae is therefore broken down into 6 subfamilies.

The results of Holmquist's review of the genus Peloscolex Leidy, 1950 based on a detailed study of 35 species (structure of the integuments, setation and reproductive system) by reconstruction of series of sections were published recently (Holmquist, 1978, 1979). Holmquist revealed certain differences in the structure of the male gonoduct (homogeneity or division of the vas deferens into two parts, the form and length of the atrium, and in some cases the separation of its parts; the point of entry of the vas deferens and prostatic gland into the atrium, the presence or absence of an ejaculatory duct and its length. etc.), which have helped to group the species. The histology of the parts of the male gonoduct was also studied. Proceeding from its structure and having established the characteristics that accompany it (the structure of the integuments, the retractibility of the prostomium and anterior segments, the presence of genital setae or a penial tubule), Holmquist divided Peloscolex into 8 genera. Four of them were described as new ones, while the rest were given back their former names. We quite agree with the establishment of the genera Edukemius Holmquist [type species E. benedii (d'Udekem, 1855)], Haber Holmquist [type species H. speciosus (Hrabe, 1931)] and Baikalodrilus Holmquist [type species B. kozovi (Hrabe, 1979)], as well as with the re-establishment of Tubificoides Lastochkin, 1937 (type species T. swirenko, Jaroschenko, 1948). Of the rest of the genera, Peloscolex Leidy (type species P. variegatus Leidy, 1950) appears to be an independent one. In our opinion, Emboloccephalus Randolph [type species E. velutinus (Grube, 1979)], Spirosperma Eisen (type species S. ferox Eisen, 1879) and Orientodrilus Holmquist with the only species O. nikolskyi (Lastochkin et

(26)

Sokolskaja, 1953), which Holmquist herself considers similar in their differences, are more like subgenera of the same genus.

The differences between them lie in the structure of the integuments, the separateness of the vasa deferentia, the relative length of the tubular, distally tapering atrium which acquires a semilunar form as it becomes shorter, the insignificant variations in the point of entry of the prostatic gland into the atrium, as well as the length of the clearly defined ejaculatory duct. As it appears from Holmquist's descriptions of the species (1979), the length and form of the atrium change. Between the species of these taxa we observe intercorrelated histological differences in the epithelium of the atrial cavity and the ejaculatory duct (presence or absence of cilia), while in O. nikolskyi there is also a substantial muscular layer in the wall of the atrium and ejaculatory duct. The differences in the location of the spermathecal apertures and the presence of spermathecal setae and a penial tubule should also be noted. In our opinion, these differences do not rise to the generic level, which is particularly obvious in a comparison with the characteristics that differentiate the other genera established by Holmquist (the complete absence of an ejaculatory duct, or the morphological and histological differentiation of the parts of the atrium, which results in a displacement of the point of entry of the vas deferens into it, the retractibility of the anterior segments, etc.). Therefore, we think it is more logical to combine these taxa in the genus Spirosperma Eisen, 1879, as it was described before the others, and to regard the other three genera singled out by Holmquist as subgenera, since they are represented by natural groups of related species.

The data in this paper and key to the families, genera and species of oligochaetes have been adapted due to the limited number of taxa found on the territories studied, and so they can be used only in the given regions.

After this paper had been submitted for publication, T. Timm proposed an oligochaeta system which deserves to be discussed (Izv. AN Est. SSR, v. 30; Biologiya, 1981, No. 3).

# I. Systematic section

## Key to families of freshwater Oligochaeta of Kamchatka and the Koryak upland\*

- 1 (10) Dorsal and ventral bundles consist of similar setae, straight or S-shaped, with edentate or bifid distal end.
- 2 (9) Not more than 2 setae in each bundle<sup>1</sup>. Setae S-shaped. Spermathecae found in front of or behind segment with male pores.
- 3 (6) Bundles of all segments consist of 2 setae each.
- 4 (5) Vasa deferentia fall into atria lined with prostatic glandular cells..... fam. Lumbriculidae
- 5 (4) Vasa deferentia open in two pairs of apertures on one (IX) segment in region of paired copulatory glands, without falling into atria. One pair of non-functional atria..... fam. Kurenkovidae
- 6 (3) Setae may be distributed not only 2 to a bundle, but singly, 8, 4 or 2 (with reduction of dorsal ones) on one segment.
- 7 (8) Setae without teeth or bifid, S-shaped, 4 pairs or only 2-4 setae on one segment. Oesophagus without calciferous glands. Vasa deferentia of 1st and 2nd pairs do not fuse. Two pairs of male pores found on segments following segments of corresponding sperm funnels, i.e. on IX-X or X-XI..... fam. Haplotaxidae

---

<sup>1</sup> The anterior (preclitellar) region of the body should be studied, since the bundles here contain a complete set of setae.

\*Russ. Koryakskoye nagor'ye - transl.

- 8 (7) Setae exclusively edentate , S-shaped or straight, 8 on each segment, sometimes paired in 4 bundles. Oesophagus with several pairs of calciferous glands. Vasa deferentia of 1st and 2nd pairs fuse, common duct extends toward male pore, intersecting several segments. One pair of male pores on (28) XV (rarely on XI-XIV segments)..... fam. Lumbricidae
- 9 (2) More than 2 setae in a bundle. Setae straight (sometimes of different length in one bundle) or S-shaped. Spermathecae far removed anteriorly (segment V) from segment bearing male pores (XII)..... fam. Enchytraeidae
- 10 (1) Ventral bundles consist of S-shaped bifid setae; dorsal bundles may contain different types - needlelike, bifid, flabellate and hairlike setae.
- 11 (12) Dorsal bundles of setae appear from segment II, III, IV, V or VI, or are absent altogether. Reproduction continuous, asexual, by paratomy. One pair of male pores in segment VI. One pair of spermathecal apertures in segment V. Small transparent worms (body length from 0.8 to 10-20 mm), frequently with eyes..... fam. Naididae
- 12 (11) Dorsal bundles of setae always from segment II No paratomy. Male pores in segment XI, spermathecal apertures in segment X. Larger worms, body length from 3-15 to 200 mm, no eyes..... fam. Tubificidae

#### Order Naidomorpha

#### 1. FAMILY NAIDIDAE

#### Key to species

- 1 (2) No dorsal bundles of setae..... genus Chaetogaster von Baer, 1 species Ch. diaphanus (Gruithuisen)
- 2 (1) Dorsal bundles of setae present, begin from segment II, V or VI.
- 3 (6) Dorsal bundles of setae begin in segment II or V, consist of bifid setae similar to ventral ones.
- 4 (5) Dorsal bundles of setae begin in segment II.....  
..... genus Homochaeta Bretscher, 1 species H. naidina Bretsch.
- 5 (4) Dorsal bundles of setae begin in segment V.....  
... genus Paranais Czerniavsky, 1 species P. birsteini Sokol.

- 6 (3) Dorsal bundles of setae begin in segment VI and contain different types of setae ( bifid , hairlike, needlelike).
- 7 (8) No hairlike setae in dorsal bundles, only bifid setae as in ventral setae..... genus Uncinais Levinsen, 1 species U. uncinata (Orsted)
- 8 (7) Hairlike setae present in dorsal bundles, also needle and bifid setae present.
- 9 (10) Prostomium with long thread-like palp... Stylaria Lamarck, 1 species S. lacustris (Linnaeus)
- 10 (9) Prostomium without appendages.
- 11 (12) Hairlike setae sturdy, sabre-shaped, serrate along convex margin..... Vejdovskyella Michaelsen, 1 species V. comata (Vejdovsky)
- 12 (11) Hairlike setae thin, straight, smooth (nonserrate).
- 13 (14) Hairlike setae of segment VI much longer (3--4-fold) than succeeding ones. Body not transparent (membrane from small particles of earth)..... Slavina Vejdovsky, 1 species S. appendiculata (d'Udekem)
- 14 (13) Hairlike setae of segment VI not much longer than succeeding ones. Body transparent (no membrane from particles of earth).
- 15 (16) Ventral setae of segments II-V no different from succeeding ones in size or form. Circulatory system of segments I-V forms a network. Spermathecal apertures in lateral position. Atria open into eversible pockets..... Specaria Sperber, 1 species S. josinae (Vejdovsky)
- 16 (15) Ventral setae of segments II-V easily distinguished from succeeding ones (in overall form, length and thickness). Circulatory system of segments I-V with simple or anastomosing commissural vessels. Spermathecal apertures in ventral position. No eversible pockets... Nais O.F. Müller
- 17 (18) Dorsal needle setae quite large, distal tooth somewhat shorter and thinner than proximal one. Spermathecal ducts fall into terminal reservoirs.... N. borutzkii Sokolskaja
- 18 (17) Dorsal needle setae very thin, with pointed or bifid taxodont distal end.

- 19 (26) Dorsal needle setae with two small teeth at distal end.
- 20 (21) Teeth of needle setae long, almost parallel. Ventral (30)  
setae of all regions of body with distal tooth twice as  
long as proximal one..... N. elinguis Müller
- 21 (20) Teeth of needle setae short, divergent. Ventral setae  
of segments II-V and succeeding ones differ in teeth ratio  
(distal tooth longer than proximal one in anterior segments,  
teeth almost equal or distal one shorter in the succeeding  
segments).
- 22 (25) Ventral setae of segments II-V with distal tooth only  
slightly longer than proximal one.
- 23 (24) Oesophagus passes into gastric expansion gradually.....  
..... N. communis Piguet
- 24 (23) Oesophagus passes into gastric expansion abruptly.....  
..... N. variabilis Piguet
- 25 (22) Distal tooth of ventral setae of segments II-V at least  
twice as long as proximal tooth..... N. pardalis Piguet
- 26 (19) Dorsal needle setae not forked on distal end (simple-  
pointed).
- 27 (28) Dorsal needle setae with long sharp distal end and only  
slightly distal (almost median) nodule... N. barbata Müller
- 28 (27) Dorsal needle setae with shorter, somewhat obtuse distal  
end and distinctly distal nodule (about 1/3 from distal  
end)..... N. simplex Piguet

#### Systematic review of species

##### Subfamily Naidinae Lotoskin, 1924

Genus Stylaria Lamarck, 1816

Stylaria lacustris (Linnaeus, 1767)

Sperber, 1948: 147-149, fig. 15L, Pl. X, XI; 1950: 68, Pl. II,  
fig. 5. Michaelsen, 1929: 317; Chekanovskaya, 1962: 159-160,  
fig. 78-79; Sokol'skaya, 1972b: 75-76.

**Description.** Eyes are usually present, though eyeless speci-  
mens are also encountered. The prostomium bears a long flexible  
palp which begins in the recess between the two lateral lobes.  
Transverse striae of a dark pigment are present on the body. The

ventral bundles each contain 4-7 bifid setae with a long curved distal tooth and a reduced proximal one; the setae are straight, with two angular curvatures in the proximal part, similar in all the regions of the body, 159-222  $\mu\text{m}$  in length. The dorsal bundles consist of 1-3 thin and long (465-1050  $\mu\text{m}$ ) hairlike setae and 3-4 needle setae 75-120  $\mu\text{m}$  in length. (31)

Length of chain (L) 5.5-18 mm, number of segments of a solitary worm (S) 23-49, number of segments in the first zooid (n) 15-35. Active, fast-swimming worms.

**Occurrence**<sup>1</sup>. Kamchatka R. at Lake Bol'shoi<sup>2</sup>; mud on the bank of the Kamchatka R., small lake in the Listvennichnaya R. delta (at Lake Kronotskoye\*).

The depth of occurrence did not exceed 0.5 m.

Mature specimens were noted on 11 June (1957).

Geographic distribution: Holarctic Region.

Genus Slavina Vejdovsky, 1883

Slavina appendiculata (d'Udekem, 1855)

Sperber, 1948: 133-136, fig. 15 A, B, 26 B; 1950: 65. fig. 16; Chekanovskaya, 1962: 169, fig. 88; Sokol'skaya, 1972b: 76.

**Description.** Light brown in colour. Eyes present. Body not transparent due to membrane from particles of earth. Ventral bundles each contain 2-5 setae with distal tooth somewhat thinner and longer than proximal one; setae on segment II longer (111-147  $\mu\text{m}$ ) than on other segments (98-135  $\mu\text{m}$ ). Dorsal bundles contain 1-2 hairlike setae and 1-2 needle setae, very thin, almost straight,

<sup>1</sup>Places of occurrence in Kamchatka listed first, followed by the water bodies in which the worms were discovered in the Koryak upland under the corresponding heading; <sup>2</sup>The asterisk here and farther in the text marks the places of occurrence of the species given in Michaelsen's paper (1929).

with a barely noticeable swelling at the distal end. Length of hairlike setae of segment II up to 800  $\mu\text{m}$ , length of the rest 270-450  $\mu\text{m}$ , length of needle setae 60-70  $\mu\text{m}$ .

L=2-20 mm; n=19-29; S=23-46.

A sluggish, slow-moving worm. Does not swim.

**Occurrence.** Lake Kronotskoye, Zaliv Unana; Lake Maloye Zuikovskoye.

In Zaliv Unana, the species is encountered on pebble beds (depth 0.5 m).

Geographic distribution: Holarctic, Sino-Indian Region, Africa.

Genus Vejdovskyella Michaelsen, 1903

Vejdovskyella comata (Vejdovsky, 1883)

Sperber, 1948: 137-140, fig. 15 C-F, 26A; 1950: 65-66, fig. 17 C-F, Pl. II, fig. 3; Chekanovskaya, 1962: 165-166, fig. 85; Sokol'skaya, 1972b: 76.

(32)

**Description.** Transparent, yellowish, very small worms. Eyes present. Sensory papillae scattered over body. Ventral bundles contain 3-6 bifid setae with the distal tooth slightly longer than the proximal one; setae in segment II longer (80-105  $\mu\text{m}$ ) and thicker than the ones following (51-92  $\mu\text{m}$ ). No thickened ("giant") setae in ventral bundles. Dorsal bundles consist of 4-8 thick sabre-shaped hairlike setae 170-420  $\mu\text{m}$  in length, with two rows of denticles along convex margin and 1-8 thin distally pointed needle setae 47-90  $\mu\text{m}$  in length.

L=1.5-8.0 mm; S=24-34; n=12-24.

Sluggish, non-swimming worms.

**Occurrence.** A small lake in the Kayum R. basin; basin of the Khairyuzovaya R.

Holarctic species.

Genus Nais O.F. Müller, 1773

Nais communis Piguët, 1906

Sperber, 1948: 102-107, Pl. VII, fig. 1; 1950: 60, fig. 10;  
Michaelsen, 1929: 316; Chekanovskaya, 1962: 184-185, fig. 100.

**Description.** Yellowish-pink in colour. Brown pigment usually present on anterior segments (I-V). Eyes sometimes lacking. Ventral bundles contain 2-6 bifid setae with the distal tooth slightly longer and thinner than the proximal one. Setae of segment II with median nodule, only slightly straighter and thinner than the rest, 63-93  $\mu$ m long, length of setae on segment V 49-66  $\mu$ m. Setae in subsequent segments 63-93  $\mu$ m long, with distal nodule. Dorsal bundles consist of 1-2 hairlike setae 90-268  $\mu$ m long and 1-2 needle setae 40-80  $\mu$ m long with short divergent teeth. Gastric expansion begins gradually. Vasa deferentia covered with prostatic cells only in distal region.

L=1.8-12 mm; S=12-32; n=10-21

**Occurrence.** Tarkhovka R.\*; Lake Kuril'skoye (depth 50-60 m).

Geographic distribution: cosmopolitan species.

(33)

Nais variabilis Piguët, 1906<sup>1</sup>

Sperber, 1948: 107-110, Pl. VI, fig. 3, Pl. VII, fig. 2; 1950: 60, Pl. I, fig. 8; Chekanovskaya, 1962: 186-187, fig. 102; Sokol'skaya, 1972b: 76.

**Description.** Dark pigment on segments I-V may or may not be present. Eyes occasionally lacking. Ventral bundles contain 2-7 bifid setae with the distal tooth longer than the proximal one. Setae in segments II-V slightly longer (69-125  $\mu$ m) and thinner than subsequent ones (60-105  $\mu$ m) and have a median or slightly

---

\*N. variabilis and N. communis are difficult to differentiate in a fixed state without resorting to microtomy, though they differ sharply in the structure of the male gonoduct and spermathecae, and in the nature of the gastric expansion. Live immature worms can be successfully differentiated by the latter of these characteristics and by the swimming ability of N. variabilis.

proximal nodule; nodule distal in subsequent segments. Dorsal bundles contain 1-2 hairlike setae 115-643  $\mu\text{m}$  long and 1-2 needle setae 49-79  $\mu\text{m}$  long with short equal teeth. Gastric expansion begins abruptly. Vasa deferentia covered with prostatic cells throughout.

L=3-10 mm; S=18-38; n=12-21.

A good swimmer (spiral movement).

**Occurrence.** A small lake in the Kayum R. basin; a small lake in the Listvennichnaya R. delta (Lake Kronotskoye); hot bath springs in the upper part of the Bystraya R. ( $t=18^{\circ}\text{C}$ ).

Mature specimens encountered on 23 July (1963).

Geographic distribution: cosmopolitan species.

Nais simplex Piguët, 1906

Sperber, 1948: 110-112, figs. 11-AC, 26E; 1950: 61, fig. 11 AC, Pl. II, fig. 1; Chekanovskaya, 1962: 182-183, fig. 38.

**Description.** Pink in colour. Pigmentation varies. Eyes present. Ventral bundles of segments II-V contain 2-6 bifid setae longer and thinner than subsequent ones, with distal tooth almost twice as long as proximal one and with proximal nodule. Setae of segment II 93-115  $\mu\text{m}$  long, setae of segment V 73-96  $\mu\text{m}$ . Ventral bundles from segment VI contain 2-5 setae 63-95  $\mu\text{m}$  long with teeth of almost equal length and a much thicker proximal tooth. Dorsal bundles contain 1-2 hairlike setae 190-262  $\mu\text{m}$  long and 1-2 edentate needle setae 65-79  $\mu\text{m}$  long, slightly obtuse distally, with a distal nodule. Gastric expansion begins abruptly.

L=4-8 mm; S=18-37; n=14-22.

Swimmer (spiral movement).

**Occurrence.** Koryak upland: Lake Potatgytkhyn, littoral zone.

Mature specimens noted on 15 September (1965).

Geographic distribution: Holarctic Region, Africa.

(34)

Nais barbata Müller, 1773

Sperber, 1948: 116-118, Pl. VIII, fig. 4; 1950: 62-63, fig. 12 AC; Chekanovskaya, 1962: 181-182, fig. 97; Sokol'skaya, 1972b: 76.

**Description.** Yellowish-brown pigment in anterior part of body. Eyes present. 2-5 setae in each ventral bundle; setae in segments II-V much thinner and straighter than in subsequent segments, 96-138  $\mu$ m long, nodule proximal, distal tooth longer and slightly thinner than proximal one. Ventral setae from segment VI become much thinner and shorter (75-113  $\mu$ m), nodule distal; distal tooth equal in length to proximal one, but considerably thinner. Dorsal bundles consist of 1-5 hairlike setae 135-311  $\mu$ m long and 2-5 needle setae 89-132  $\mu$ m long, with a very long and sharp distal end and only a slightly distal nodule. Gastic expansion begins abruptly.

L=3.5-6 mm; S=25-33; n=11-19.

Swimmer (spiral movement).

**Occurrence.** Lake Ushkovskoye; Lake Kronotskoye, Zaliv Unana.

Species encountered at a depth of 0.5 m on pebbles or volcanic stones and pebbles with sand. Mature specimens noted on 3 October (1963).

Geographic distribution: Holarctic Region, Sino-Indian Region.

Nais pardalis Piguët, 1906

Sperber, 1948: 124-126, fig. 13 N-P, Pl. VIII, fig. 5, 6; 1950: 63-64, fig. 14 N-P; Chekanovskaya, 1962: 187-188, fig. 103; Sokol'skaya, 1972b: 76.

**Description.** Brown pigment in anterior part of body. Eyes present. Ventral bundles of segments II-V contain 2-3 bifid setae, longer (90-135  $\mu\text{m}$ ) and thinner (1.9-2.4  $\mu\text{m}$ ) than the succeeding setae, with distal tooth 1.5-2.0 times longer than proximal one, with medial or slightly proximal nodule. Ventral bundles from segment VI contain 1-5 setae with distal nodule: normal ones (64-82  $\mu\text{m}$  long and 2.3-3.0  $\mu\text{m}$  thick) with the distal tooth longer, equal to or slightly shorter than proximal one, and thickened ones (80-108  $\mu\text{m}$  long and 3.5-3.7  $\mu\text{m}$  thick) with the distal tooth 2-3 times longer than the proximal one. Dorsal bundles contain 1-2 hairlike setae 90-215  $\mu\text{m}$  long and 1-2 needle setae 60-82  $\mu\text{m}$  long with thin and short equal teeth and a distal nodule. Gastric expansion begins abruptly; an accumulation of elongated conical cells with a posteriorly directed apex is found at the point where the oesophagus passes into the stomach. (35)

L=2.5-7 mm; S=19-32; n=13-21.

Swimmer (spiral movement).

**Occurrence.** Lake Ushkovskoye (depth 0.5 m, substrate volcanic stones, pebbles and sand).

Geographic distribution: Holarctic Region, Africa.

Nais elinguis Müller, 1773

Sperber, 1948: 127-130, fig. 14 A-C, Pl. IX, figs. 1-3; 1950: 64, fig. 15; Chekanovskaya, 1962: 185-186, fig. 101.

**Description.** Anterior region of body with brownish-red pigment. Eyes sometimes lacking. Ventral bundles contain 2-3 bifid setae with distal nodule and with distal tooth twice as long as proximal one; setae of segments II-V slightly longer (72-112  $\mu\text{m}$ ) and thinner than succeeding ones (72-105  $\mu\text{m}$ ). Dorsal

bundles contain 1-3 hairlike and needle setae. Hairlike setae 150-305  $\mu$ m long. Needle setae with long (almost parallel) teeth and distal nodule (1/4-1/3 from apex), 58-99  $\mu$ m long. Gastric expansion begins gradually.

L=2.2-12 mm; S=15-37; n=12-21.

Swimmer (sinusoidal movement in horizontal plane).

**Occurrence.** Hot bath springs in the upper part of the Bystraya R. ( $t=18^{\circ}\text{C}$ ).

Geographic distribution: cosmopolitan species.

Nais borutzkii Sokolskaja, 1964

Sokol'skaya, 1964: 60-64, fig. 2-4; 1972b: 76.

**Description.** Eyes present. Ventral bundles in all segments with distal tooth longer and thinner than proximal one and with distal nodule; ventral bundles in segments II-V contain 4-5 setae 92-113  $\mu$ m long; ventral setae from segment VI highly curved, 92-105  $\mu$ m long, 3-4 in a bundle. Dorsal bundles contain 1-2 thin, short (105-126  $\mu$ m) hairlike setae and 1-2 bifid setae 80-84  $\mu$ m long, distal tooth of these setae is shorter and thinner than proximal tooth, with distal nodule. Gastric expansion begins abruptly. Spermathecae fall into terminal reservoirs.

L=3.8-8.0 mm; S=26-48; n=18.

**Occurrence.** Zhupanovsky liman.

Mature specimens noted in August (1959).

Brackish-water species.

Geographic distribution: Kamchatka, Southern Sakhalin.

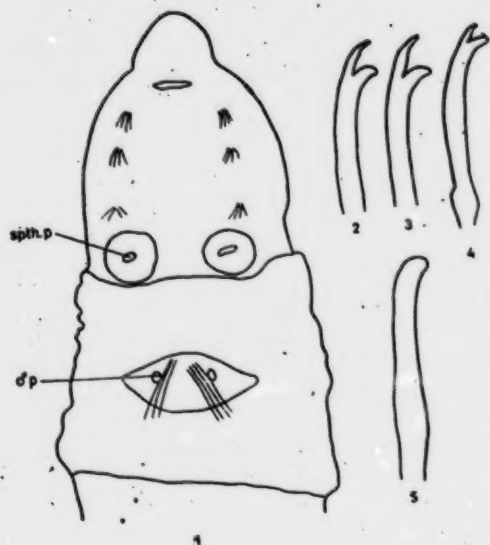


Fig. 1. Nais borutzkii Sokolskaja:

1 - anterior region of body (view from the ventral side) (x200);  
2, 3 - ventral setae of segments II and XII; 4 - dorsal bifid  
seta; 5 - penial seta (x1350); sph. p. - spermathecal pore,  
♂ p - male pore

Genus Specaria Sperber, 1939

Specaria josinae (Vejdovsky, 1883)

Sperber, 1948: 95-98, fig. 9, 26D, Pl. IV, Pl. V, fig. 1; 1950:  
58, fig. 7; Chekanovskaya, 1962: 191-192, fig. 107.

**Description.** Pale pink with yellowish hue. No eyes. All ventral setae of the same type, with longer distal tooth and almost medial or slightly distal nodule, 69-88  $\mu$ m long, 5-10 in a bundle. Dorsal bundles contain 2-6 hairlike setae 135-180  $\mu$ m long and 2-6 bifid setae 72-85  $\mu$ m long, curved, with teeth of equal length and a distal nodule. Segment VI with one pair of circular branching vessels.

L=3-10 mm; S=14-53; n=11-27.

Not a swimmer.

**Occurrence.** Khairyzovaya R. basin; Lake Kronotskoye, Uzon and Krodakyg bays.

In the bays of Lake Kronotskoye encountered at considerable depths (9-15 m) and on a silty or silty-sandy bottom.

Holarctic species.

Genus Uncinais Levinsen, 1884

Uncinais uncinata (Orsted, 1842)

Michaelsen, 1929: 316 (Paranaïs); Sperber, 1948: 98-99, fig. 26, Pl. V, figs. 2-4; 1950: 58-59, fig. 8; Chekanovskaya, 1962: 197-198, fig. 112; Sokol'skaya, 1972b: 76.

**Description.** Prostomium obtuse, rounded. Anterior region of body complete, body narrows posteriorly. Dark brown spots in anterior segments. Eyes present. All ventral and dorsal setae of the same shape, with distal tooth longer and thinner than proximal one. Ventral bundles contain 2-7 setae, setae in segment II longer (120-126  $\mu$ m) than in succeeding ones, with proximal nodule; setae from segment VI with distal nodule, 96-110  $\mu$ m long. Dorsal bundles contain 2-4 setae 86-102  $\mu$ m long, with distal nodule.

L=5-18 mm; S=31-54; n=19-27.

Good swimmer (spiral movement).

**Occurrence.** Khairyuzovaya R. basin, including Bystraya R.; Lake Kronotskoye, Uzon and Krodakyg bays; Kamchatka R. basin, lakes Shirokoye and Azabach'ye; Tarkhovka R.\*; Lake Kul'tuchskoye\*(?).

In Lake Azabach'ye species encountered at depth of 0.7-1.0 m, on a silty bottom in overgrowths of macrophytes; in bays of Lake Kronotskoye at considerable depths (9-15 m) on a silty bottom. Mature specimens noted on 25 August (1965), 1 September (1972) and 5-7 October (1963).

Holarctic species.

Genus Homochaeta Bretscher, 1896

Homochaeta naidina Bretscher, 1896

Michaelsen, 1929: 316 (Paranaïs); Sperber, 1948: 92-93; 1950: 57; Chekanovskaya, 1962: 198.

**Description.** Anterior region of body pigmented. Prostomium elongated, tapered. No eyes. Ventral bundles contain 3-5 bifid setae with the teeth of equal length. Dorsal bundles of segments II-V contain 5-6 bifid setae, longer and thinner than on the succeeding segments, with the distal tooth longer than the proximal one; dorsal bundles of succeeding segments consist of 3-5 setae with teeth of equal length. (38)

L=8 mm; S=20.

**Occurrence.** Lake Kuril'skoye\* (at a depth of 50-60 m).

Palearctic species.

**Subfamily Paranaidinae** Sperber, 1948

Genus Paranaïs Czerniavsky, 1880

Paranaïs birsteini Sokolskaja, 1971  
(fig. 2)

Sokol'skaya, 1961: 54-55 (Paranaïs, sp.); 1971: 930-933, fig.

**Description.** Prostomium short, with rounded apex, ratio of length to width of base 5:6. No eyes. Epidermis forms folds (up to 9 per segment) which give the integuments a cross-striated pattern. Ventral and dorsal bundles consist of uniform bifid setae with distal nodule and the distal tooth noticeably longer than the proximal one. Ventral bundles of segment II contain 5-7 setae 84-96  $\mu$ m long, with a curved distal tooth twice as long as the proximal one. In caudal direction, number of setae per bundle decreases to 3-4, and their length to 71  $\mu$ m. Dorsal bundles

of segments V-VIII contain 4-6 setae about 78  $\mu$ m long; number of setae per bundle in middle part of body decreases to 3-4, and their length to 71-75  $\mu$ m. Atrial ampulla elongated, thick-walled, with a well-developed muscular layer. Spermathecae with a small spheroid or slightly dorsoventrally flattened ampulla and a well-delineated short and thick duct.

L=3.5-5.0 mm, S=26-35.

**Occurrence.** Lake Ushkovskoye; warm mud in the caldera of the Uzon volcano. Koryak upland: Lake Chayach'ye (Pakhacha R. basin).

We first noted the species in the caldera of the Uzon volcano where it was encountered in large numbers (up to 130 specimens per sample) and recorded it as Paranaïs sp., for it was represented only by immature specimens. After mature worms had been found in Lake Ushkovskoye (29 Sept 1965), the new species P. birsteini was described (Sokol'skaya, 1971).

(39)

The species is encountered on silty and stony bottoms, and is apparently a eurythermal species; it has been found in the warm mud of the Uzon caldera in April at  $t=21.4^{\circ}\text{C}$ , and in Lake Chayach'ye at the end of July at  $t=12.4^{\circ}\text{C}$ .

Geographic distribution: Kamchatka, Koryak upland.

(40)

#### **Subfamily Chaetogastrinae Sperber, 1948**

Genus Chaetogaster von Baer, 1827

Chaetogaster diaphanus (Gruithuisen, 1828)

Sperber, 1948: 66-68, figs. 5, 7D, 1, Pl. I, figs. 5-6; 1950: 52, fig. 3D; Chekanovskaya, 1962: 206-207, fig. 119; Poddubnaya, 1966: 120-124, fig. 1-4; Sokol'skaya, 1972b: 77.

**Description.** Body transparent, colourless. Prostomium weakly developed, with slit-like notch along median line. Pharynx

long ( $1/6$  of body length), oesophagus quite discernible ( $1/8$  of pharynx length). Statocyst present in suprapharyngeal ganglion. Setae forked, with distal tooth longer than proximal one. Setae on segment II number 6-13, longest ones reach 200-350  $\mu\text{m}$ . Setae in succeeding segments number 5-10, length varies from 100 to 212  $\mu\text{m}$ . Penial setae (segment VI) almost straight, with forked distal end and distal nodule, 2-7 to a bundle, length 112  $\mu\text{m}$ . Vas deferens short, atrium spherical or oval. Spermathecae with pear-shaped or spherical ampulla, spermathecal duct with distal expansion.

L=2.5-25 mm, S=12-15, n=9-14.

**Occurrence.** Lake Kronotskoye, Krodakyg Bay; a small lake in the Listvennichnaya R. delta. Koryak upland: Lake Potatgytkhyn.

Encountered at a depth of 0.5-1.2 m, and in Krodakyg Bay considerably deeper (up to 9.5 m); found on a silty bottom with sand, and on silty sand with pebbles.

Mature specimens noted at the beginning of October (7 October 1963).

Geographic distribution: Holarctic Region, Sino-Indian Region.

## 2. FAMILY TUBIFICIDAE

### Key to species

- 1 (8) Large granular coelomocytes in body cavity.
- 2 (3) Ciliated pit on dorsal side of prostomium. Dorsal pores present. Male pore unpaired, medial. No spermathecae. Spermatophores attached on surface of segment XI. Prostatic cells cover only proximal part of atrium.....  
..... Bothrioneurum Stolc, 1 species B. vej dovskyanum Stolc

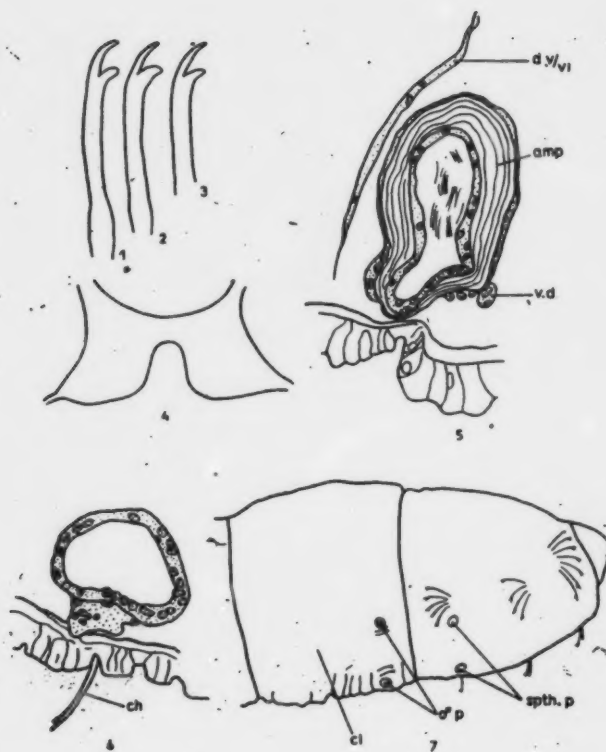


Fig. 2. Paranais birsteini Sokolskaja:

1, 2 - ventral setae of segments II and XIV; 3 - dorsal seta of segment XV (x1350); 4 - cephalic ganglion; 5 - sagittal section of atrium (x400); 6 - spermatheca; 7 - anterior region of body, amp - atrial ampulla; v.d. - distal end of vas deferens, dV/VI - dissepiment separating segments V and VI (ch - ventral seta of segment IV, cl - clitellum, sph. p. - spermathecal pores, ♂ p - male pores)

(41)

- 3 (2) No ciliated pit on prostomium, no dorsal pores. Male pores paired. Spermathecae present. No spermatophores. Prostatic cells cover entire surface of atrial ampulla.....  
 ..... Rhyacodrilus Bretscher
- 4 (7) Dorsal bundles of anterior (preclitellar) segments contain hairlike and fan-shaped setae (see figs. 3, 4).
- 5 (6) No modified spermathecal setae. Atrial ampullae ovate, vasa deferentia fall into them subapically.....  
 ..... Rh. coccineus (Vejdovsky)

- 6 (5) Spermathecal setae present, with a long distal tooth and a reduced proximal tooth (fig. 3). Atria tubular, vasa deferentia fall into them apically... Rh. svetlovi Sokolskaja
- 7 (4) No hairlike or fan-shaped setae. Dorsal bundles contain S-shaped setae with forked distal end (fig. 5).....  
..... Rh. levanidovae Sokolskaja
- 8 (1) No large granular coelomocytes.
- 9 (10) Up to 16 spherical or oval prostatic glands fall into atrium..... genus Alexandrovia Hrahe,  
1 species A. ringulata (Sokolskaja)
- 10 (9) One prostatic gland falls into atrium.
- 11 (14) Dorsal and ventral bundles contain similar S-shaped setae with forked distal end..... Limnodrilus Claparède
- 12 (13) Ventral setae of anterior segments with distal tooth 2-3 times longer than proximal one (fig. 9, 1). Ratio of length of penial tubule to width of its base 4-5:1. Spermathecal duct does not form distal expansion.....  
..... L. udekemianus Claparède
- 13 (12) Ventral setae of anterior segments with distal tooth shorter, equal to, or slightly longer than proximal one. Ratio of length of penial tubule to width of its base 4-7:1. Spermathecal duct forms distal expansion (fig. 6, 1-2)..... L. helveticus Piguet
- 14 (11) Dorsal bundles contain hairlike and fan-shaped setae.
- 15 (22) Body integuments with thin cuticle, transparent. No epidermal sensory papillae. Prostomium and anterior segment non-retractile.
- 16 (19) Vas deferens longer than atrium with penis, highly contorted..... Tubifex Lamarck
- 17 (18) Proximal diameter of cuticular penial tubule exceeds its length (fig. 7). Spermatheca without duct..... (42)  
..... T. hrabei Sokolskaja
- 18 (17) Proximal diameter of penial tubule considerably smaller than its length (fig. 8). Spermatheca with duct.....  
..... T. kessleri americanus Brinkhurst et Cook

- 19 (16) Vas deferens shorter than atrium with atrial duct and penis, slightly contorted, wide.
- 20 (21) Penial tubule cone-shaped. No atrial duct.....  
..... genus Ilyodrilus Eisen, 1 species I. templetoni (Southern
- 21 (20) Penial tubule pot-shaped (fig. 10). Very long and contorted atrial duct present.....  
..... Ilyodriloides potatiensis, gen. et sp. n.
- 22 (15) Body covered with secretion mixed with foreign particles, non-transparent or not quite transparent. Secretion with foreign particles forms papillate structures, oval bodies, or is concentrated mainly in the intersegmental and secondary furrows, giving the integuments a cross-striated (ringed) pattern (in this case the integuments are thinner and more transparent). Epidermal sensory papillae present. Prostomium and at least part of first segment retractile...  
..... genus Spirosperma Eisen
- 23 (24) Integuments relatively thin, cross-striated, do not form shaped bodies. No spermathecal setae. Cuticular penial tubule present, leaving distal end of penis free.....  
... S.(Spirosperma) apapillatus (Lastochkin et Sokolskaja)
- 24 (23) Integuments thick, with papilliform structures or oval bodies. Spermathecal setae present (figs. 12, 13). No cuticular penial tubule.
- 25 (26) Integuments with papilliform structures. Ventral setae of middle and posterior segments thin. Spermathecal apertures do not coincide with the openings of the sac of the spermathecal setae, and occupy a ventrolateral position...  
..... S.(Embolocephalus) kurenkovi (Sokolskaja)
- 26 (25) Integuments with oval bodies. Ventral setae of middle and posterior segments large, highly S-shaped, thick, with a large proximal tooth (fig. 13). Spermathecal aperture coincides with opening of sac of spermathecal seta..... (43)  
.... S.(Orientodrilus) nikolskyi (Lastochkin et Sokolskaja)

**Systematic review of species**

**Subfamily Rhyacodrilinae Hrabe, 1954**

Genus Rhyacodrilus Bretscher, 1901

Rhyacodrilus svetlovi Sokolskaja, 1976

(fig. 3)

Sokol'skaya, 1976b: 1094-1097, fig.; 1976c: 89-92, fig. 1.

**Description.** Prostomium wide, dome-shaped or spherical-quadrangular, less commonly conical. Anterior segments with secondary annulation (up to 5-6 rings). Epidermis contains granules arranged in transverse bands coinciding with the secondary rings.

Ventral bundles of anterior segments contain 4-6 (7) forked setae, distal tooth longer and thinner than proximal tooth, distal nodule present. Number of setae in bundles decreases to 2-3 posteriorly, distal tooth becomes shorter (fig. 3). Ventral setae of segment X transformed into spermathecal setae, longer than locomotory ones, with a very long distal tooth, proximal tooth reduced to various degrees, 2-3 in a bundle. Penial setae 3-4 in a bundle, with a hook-shaped forked or edentate distal end and a distal nodule (8:20) 86-123  $\mu$ m long. Dorsal bundles of anterior segments XIII-XV each contain 2-3 hairlike setae and up to 4 (usually 3) fan-shaped setae with a longer and thinner distal tooth. In the middle of the body, the hairlike setae disappear and the dorsal bundles contain 2-3 forked setae similar to the ventral ones, but with intermediate denticles (fig. 3).

Clitellum on segments X-XII (1/n XIII). Spermathecal apertures on segment X near the anterior intersegmental furrow on the line of the ventral setae or slightly more laterad. Male pores

on segment XI slightly more laterad the line of ventral setae.  
Female pores in intersegmental furrow XI/XII.

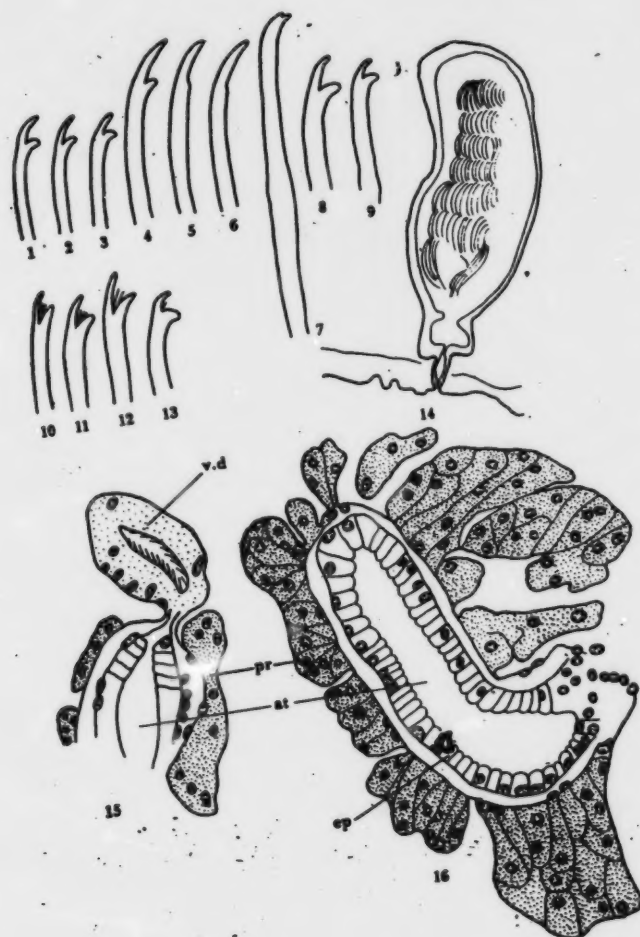


Fig. 3. Rhyacodrilus svetlovi Sokolskaja:

1, 2, 3 - ventral setae of segments II, III and IV; 4, 5, 6 - spermathecal setae; 7 - penial seta; 8, 9 - ventral setae of segment XXXII and caudal segment; 10-13 - dorsal fan-shaped setae (10, 11 - of segment II, 12 - of segment XXXII, 13 - of caudal region) (x1350); 14 - spermatheca; 15 - point at which vas deferens falls into atrium; 16 - part of atrium (x600) (at - atrium, ep - epithelium of atrial cavity, pr - prostatic cells, v.d. - vas deferens)

(45)

Pharynx in segments II-III, chromophil cells in segments III, IV and V. Chloragogue cells cover intestine from segment V. The length of the thick, almost uncontorted vasa deferentia with

a narrow ciliate canal varies; they may be shorter, equal to, or somewhat longer than the narrow tubular atrium which is straight or forms a geniculate curvature. The spermathecae have sacciform or cylindrical ampullae (unfilled ones may be almost spheroid) and short ducts. The anterior and posterior seminal vesicles and ovisacs are unpaired.

Body dimensions:  $l=6.5-14.0$  mm, diameter in clitellar region  $0.6-0.8$  mm,  $S=40-65$ .

The specimens found in the Kustovaya R. differ somewhat from the worms of the Chukchi Peninsula, on the basis of which this species was described, and this has made it necessary to alter its diagnosis somewhat.

**Occurrence.** Koryak upland: Tololayevka R., upper third. Penzhina R. basin: Kustovaya R.

The specimens from the above-mentioned rivers are distinguished by their much smaller body dimensions ( $6.5-8.0$  mm) as compared with the worms from the water bodies of the Chukchi Peninsula ( $9-14$  mm), and by a smaller number of segments. In the structure of the male gonoduct, we observed significant variations in the length of the vas deferens which measured a maximum  $245\text{ }\mu\text{m}$  with a diameter of  $30\text{ }\mu\text{m}$ . The length of the tubular atrium also varied ( $170-259\text{ }\mu\text{m}$ ) with the diameter at a constant  $43\text{ }\mu\text{m}$ . The diameter of the granular nuclear coelomocytes in series of sections stained with Ehrlich's hematoxylin was  $10-12\text{ }\mu\text{m}$ .

The species was encountered at depths of  $0.15-0.25$  m with a current velocity of  $60\text{ cm/s}$  and a temperature of  $6-10.5^{\circ}\text{C}$  (in August). Mature specimens were found in the first half of August (1972).

Geographic distribution. Chukchi Peninsula, Koryak upland.  
Penzhina R. basin.

Rhyacodrilus coccineus (Vejdovsky, 1875)  
(fig. 4)

Michaelsen, 1929: 320 (Rh. riabuschinskii); Sokol'skaya, 1961:  
55; 1972b: 78; 1976c: 92, fig. 2 (Rh. leonidi).

**Description.** Body bright red. Prostomium elongated, conical or spherical. Anterior segments biannulate. Ventral bundles of anterior (preclitellar) region of body with 3-7 forked setae, distal tooth slightly longer and thinner than proximal tooth; number of setae in bundles decreases to 2 in posterior region. Dorsal bundles of anterior region contain 3-5 hairlike and 3-7 fan-shaped setae with equal marginal teeth or a slightly longer distal tooth. Variable number of segments behind clitellum without hairlike setae, and dorsal bundles contain only forked setae with proximal tooth longer and thicker than distal one. Penial setae 2-5 in a bundle, almost straight, with a distal nodule, hook-shaped at the distal end, without teeth or with reduced ones. (47)

Clitellum on segments X-XIV. One pair of male pores on segment XI; one pair of female pores in intersegmental furrow XI/XII; one pair of spermathecal apertures on segment X, on the line of ventral setae behind intersegmental furrow IX/X.

Commissural vessels in segments VI-VIII form "hearts".

Vasa deferentia contorted, comparatively short and wide, fall into atrial cavity subapically. Atria with spheroid or ovate ampullae, covered with prostatic cells, and with short ducts. Wall of atrial ampulla has a thin muscular layer. Spermathecae are not connected with the intestine; they have a spheroid or ovate ampulla and a very short and thick duct.

Body dimensions:  $l=10-35$  mm, diameter up to 1.0 mm,  $S=60-110$ .

**Occurrence.** Lake Palanskoye; Khairyuzovaya R. basin; Kamchatka R. basin (Lake Beloye, Lake Kharchinskoye and its springs, Lake Sobach'ye, Lake Kurarochnoye and the B. Kurarochnyi spring, Lake Kenuzhen, Lake Kamenskoye, Lake Azabach'ye, Lake Soldatskoye and its springs, Soldatskaya R.); the stream in the warm mud of the Uzon caldera at a temperature of  $21^{\circ}\text{C}$ ; Lake Nachikinskoye and the Nachikinsky springs; Lake Tolmachevskoye; hot bath springs (temperature  $14^{\circ}\text{C}$ ). Koryak upland: Lake Potatgytkhyn.

The species is encountered in lakes, rivers and springs at depths from 0.5 to 15 m on a sandy bottom, silt with sand, or on a clean silty bottom (gray, black). Rh. coccineus has been noted in warm waters (Uzon caldera). Mature specimens have been encountered from 1 June to 20 August and in September during different years.

The Kamchatka specimens of Rh. coccineus had biannulate segments with a narrow anterior and a wide setaceous ring in front of the clitellum. The ventral bundles of the anterior segments had 6-7 setae, the distal tooth of which was longer and thinner than the proximal one and slightly curved. The dorsal bundles of the preclitellar segments contained up to 6 pubescent hairlike setae and 4-5 fan-shaped setae; the marginal teeth of the latter were usually quite long and the distal tooth was slightly longer and thinner than the proximal one; the angle of divergence of the marginal teeth sometimes varied within one bundle. There were no hairlike setae in the posterior and part of the middle part of the body. Behind segment XX, they were usually encountered

irregularly, with intervals of 1-2 or several segments, and then disappeared. The location of the last segment with hairlike setae varied from XXII to XXXVIII.

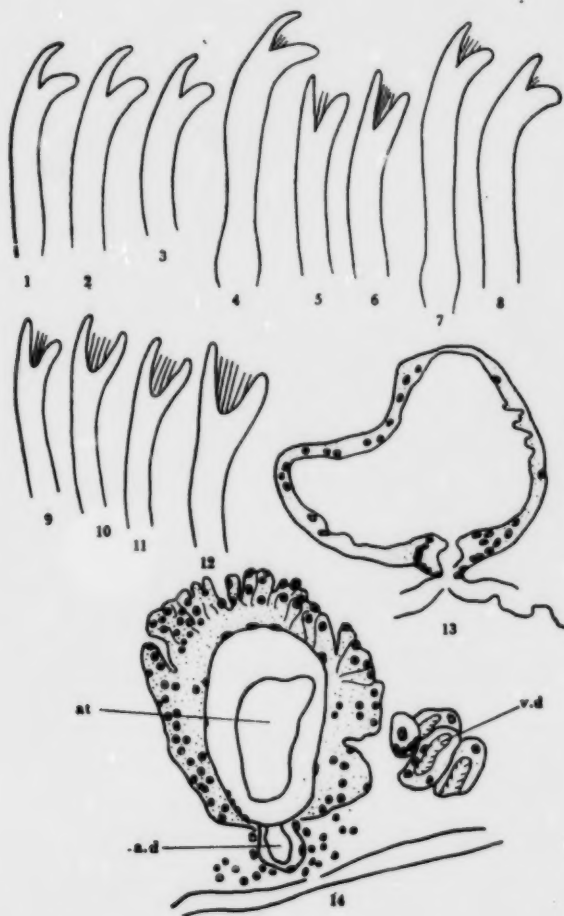


Fig. 4. Rhyacodrilus coccineus (Vejdovsky):

1, 2, 3 - ventral setae of segment V and succeeding segments in front of clitellum; 4 - ventral seta behind clitellum; 5, 6 - dorsal setae of anterior segments; 7 - dorsal seta behind clitellum; 8 - dorsal seta of caudal region; 9-12 - structural variations of distal end of dorsal setae of a specimen in front of clitellum (9 - segment III, 10 - segment IV, 11 and 12 - segment VI) (x1800); 13 - spermatheca (x400); 14 - atrium (x400) (at - atrial ampulla, a.d. - atrial duct, v.d. - vas deferens)

The ciitellum is on segments X-1/2 XIII. When it is fully developed, the male pores and the penial setae of both sides of the body are found in a lentiform area without any glandular cells. The penial setae number 2-5 in a bundle, are 121-125  $\mu\text{m}$  long, and have a distal nodule.

The pharynx is found in segments II-III, and the chromophil cells are in segments IV, V and VI. The chloragogue tissue covers the intestine from segment VI. The diameter of the nuclear granular coelomocytes (in series of sections) is 17-22  $\mu\text{m}$ .

The vasa deferentia are wide; their diameter may vary even in the right and left halves of the body of one specimen (26-30, 34-39, 43-52  $\mu\text{m}$ ). The atria have ovate, usually elongated ampullae (length/width ratio varies from 1.5:1 to 2:1 even in one worm). The length (height) of the atrial ampulla is 112-146  $\mu\text{m}$ , and the maximum diameter 60-78  $\mu\text{m}$ .

The atrial duct is much shorter than the ampulla (ratio of ampulla length to duct length varies from 1.6:1 to 2:1). The absolute length of the duct varies from 64 to 80  $\mu\text{m}$ , and the mean diameter from 34 to 39  $\mu\text{m}$ . Specimens with pseudopenises were encountered in some cases (Lake Kenuzhen).

The spermathecae (empty and full) had irregularly ovate ampullae, the width of which greatly exceeded the height. The size of the empty ampullae (width 198-203  $\mu\text{m}$ , height 96-104  $\mu\text{m}$ ) was much smaller than that of the full ones (width 237-279, height 147-259  $\mu\text{m}$ ). The spermathecal duct is short (56-60  $\mu\text{m}$ ), wide (47-65  $\mu\text{m}$ ) and thick-walled (22  $\mu\text{m}$ ), and the length/diameter ratio approximates 1 (0.9-1.2).

The seminal vesicle begins from dissepiment X/XI and extends posteriorly into segment XVIII.

Body dimensions: l - up to 24 mm, diameter - up to 1.0 mm, S = 65-95.

A specimen with its reproductive system displaced anteriorly by 2 segments was found in Lake Potatgytkhyn on 10 September 1965.

A specimen of Rh. coccineus with a multiple reproductive system displaced anteriorly by one segment (described below) was found in the Soldatskaya R.

The clitellum is found in segments IX--1/2 XIII. On the ventral side of segments X and XI, the clitellum has lentiform areas without any glandular cells. One pair of spermathecal apertures is found on segment IX in intersegmental furrow VIII/IX on the line of the ventral setae. Two pairs of male pores are found in the posterior third of segments X and XI, and 2-3 pairs of female pores are found in intersegmental furrows X/XI, XI/XII and XII/XIII (posterior female pore lacking in one half of the body). (49)

The penial setae (up to 3 in a bundle) are found on segments X and XI.

One pair of testes in segment IX extends from the ventral part of dissepiment VIII/IX. Three pairs of large ovaries in segments X, XI and XII extend from their anterior dissepiments.

One pair of well-developed sperm funnels opens in segment IX, and is attached to the anterior surface of dissepiment IX/X. One pair of wide, slightly contorted vasa deferentia falls subapically into the anterior pair of atria (in segment X).

There are two pairs of atria in segments X and XI. The atrial ampullae of the anterior pair are oviform and somewhat larger than the spheroid ampullae of the second pair. The atrial ducts are developed to the same extent in the anterior and posterior pairs. The posterior pair of atria does not receive vasa deferentia. The seminal vesicle begins from dissepiment IX/X and extends posteriorly for several segments inside the ovisac which begins from dissepiment XI/XII. One pair of spermathecae with an irregularly ovate ampulla and a short muscular duct is found in segment IX.

The specimen had full spermathecae, seminal vesicles and ovisacs. It is characterized by a triple female reproductive system, one pair of testes, sperm funnels and vasa deferentia, and two pairs of male pores and atria, of which the posterior pair does not receive vasa deferentia.

Doubling of the reproductive system with simultaneous displacement of it anteriorly by 2 segments was observed in Rhyacodrilus by Michaelsen (1929) who encountered specimens with a double male gonoduct (in segments IX and X) with one pair of testes, two pairs of ovaries and one pair of female pores. These worms were described as the new species Rh. riabuschinskii Michaelsen. A special study of cases of a displaced reproductive system in Rh. coccineus allowed us to reduce Rh. riabuschinskii to a synonym of Rh. coccineus (Sokol'skaya, 1968). This is also confirmed by the above description of the reproductive system of Rh. coccineus from the Soldat-skaya R.

In some of the water bodies of Kamchatka (Lake Kharchinskoye, Eul'chinok, channel from Lake Grob ), we have encountered immature

worms belonging to the genus Rhyacodrilus, in which the dorsal hairlike setae continued (with intervals) up to segments LVII-LXXXIII. The immaturity of the worms and insufficient fixation have kept us from identifying them to the species level.

(50)

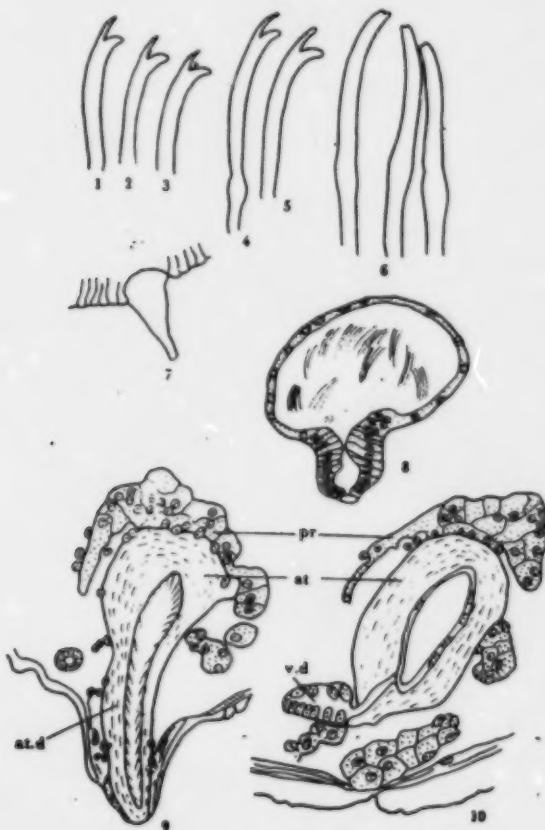


Fig. 5. Rhyacodrilus levanidovae Sokolskaja:

1-3 - ventral setae (1 - segment V; 2, 3 - posterior segments); 4, 5 - dorsal setae of segment VII and penultimate segment; 6 - penial setae (x1350); 7 - part of the body with protruding pseudopenis (x100); 8 - spermatheca; 9 - distal part of atrial ampulla and atrial duct; 10 - point of entry of vas deferens into atrium (x400) (at - atrial ampulla, at.d. - atrial duct, pr - prostatic cells, v.d. - distal part of vas deferens)

Rhyacodrilus levanidovae Sokolskaja, 1973

(fig. 5)

Sokol'skaya, 1973a: 54-57, figs. 1-2.

**Description.** Prostomium elongated, with rounded apex. Body integuments thick, not very transparent, with a granular cuticle; (51) wide bands of a granular structure (from 2 to 8-9 in a segment) alternate with narrow non-granular strips, forming a cross-striated pattern. Dorsal and ventral bundles consist of similar forked setae, thin, S-shaped, with a distal nodule. Distal tooth in anterior (preclitellar) segments longer and thinner than proximal tooth, setae 3-6 in a bundle, 84-97  $\mu\text{m}$  long. Number of setae per bundle in posterior segments 3-5, relative length of distal tooth decreases; ventral setae of posterior segments sometimes with intermediate denticles. Penial setae (segment XI) somewhat thicker than locomotory setae, 88-101  $\mu\text{m}$  long, with well-defined distal nodule and two reduced denticles at distal end, 3-4 in a bundle.

Clitellum saddle-shaped, on segments X-XII. One pair of male pores on segment XI on line of setae (sometimes behind it) and more ventrad the ventral bundles. One pair of female pores in intersegmental furrow XI/XII. One pair of spermathecal apertures on segment X in intersegmental furrow IX/X in the lateral line.

Pharynx and chromophil cells in segment III, oesophagus begins in segment IV, chloragogue tissue covers intestine from segment V. Body cavity contains spheroid granular nuclear coelomocytes 13-24  $\mu\text{m}$  in diameter (measured on sections). Vasa deferentia short, not very contorted, with fairly thick (7-8  $\mu\text{m}$ ) walls and the same diameter (21  $\mu\text{m}$ ) throughout. Vas deferens enters anterior wall

of distal part of atrium, passes through it into the proximal part of the ampulla where it opens into the atrial cavity. One pair of atria with a sacciform thick-walled ampulla 112-140  $\mu$ m long and 71-97  $\mu$ m in diameter, covered with a layer of prostatic cells. Atrial duct cone-shaped (length 126  $\mu$ m, proximal diameter 42  $\mu$ m, distal diameter 25  $\mu$ m), with a thick muscular wall (10-13  $\mu$ m) functioning as a pseudopenis. Spermathecae with a round or oval thin-walled (4  $\mu$ m) ampulla 88-143  $\mu$ m in diameter, and a short (46  $\mu$ m) and wide (42  $\mu$ m) thick-walled (13-19  $\mu$ m) duct. Seminal vesicles unpaired: small anterior one extends from dissepiment IX/X into segment IX, posterior one from dissepiment X/XI up to segment XII. Ovisac goes into segment XIII.

Body dimensions: l = 9-10 mm, maximum diameter 0.4 mm, S = 36-53.

**Occurrence.** Kamchatka R. basin (lakes Ushkovskoye and Azabach'ye).

The species was encountered at a depth of 0.2-18 m, in shallow water (in volcanic sand and on a sandy bottom with stones) and at large depths (on a silty bottom, sometimes with a mixture of sand). (52) Mature specimens were noted at the end of March, in August and at the beginning of November (1965).

Rh. levanidovae is similar to the European Rh. falciformis Bretscher, 1901 in some of the characteristics of the reproductive system (form of the atrial ampulla, the point of entry of the vas deferens into the atrial wall, the absence of any connection between the spermatheca and intestine and the lateral position of the spermathecal pores). It is apparently closer to this species

than to the other members of the genus which, like Rh. levanidovae, do not have hairlike setae, i.e. the Tibetan Rh. stephensoni Cernosvitov, 1942, the Baikal species and the cave-dwelling Rh. balmensis Juget, 1959 (Sokol'skaya, 1973a).

Geographic distribution: Kamchatka.

**Subfamily Bothrioneurinae Cekanovskaja, 1972**

Genus Bothrioneurum Stolc, 1888

Bothrioneurum vej dovskyanum Stolc, 1888

(fig. 6; 4-12)

Chen, 1940: 102, fig. 29; Chekanovskaya, 1962: 289, fig. 183; Sokol'skaya, 1972b: 78-79.

**Description.** Orange-yellow in colour. Prostomium with ciliated pit on dorsal side. Dorsal pore present on all segments beginning with IV. Ventral and dorsal bundles contain similar forked setae, bundles in anterior part of body 3-6 setae with the distal tooth longer and thinner than the proximal one, bundles in middle region 3 setae, and bundles in posterior region 2 setae each with teeth of equal length, but with a thinner distal tooth. Penial setae with hooked distal end, under which there are two rows of denticles, up to 5 in a bundle.

Clitellum on segments 1/2 VIII-XII. Unpaired male pore occupies medial position on ventral side of segment XI. One pair of female pores behind intersegmental furrow XI/XII laterad the line of ventral setae. Spermatophores attached on dorsal and lateral sides of segment XI.

Chloragogue cells cover intestine from segment V or VI. Contractile annular vessels in segments VIII and IX. Coelomocytes large, granular. Vasa deferentia short (300  $\mu$ m), with ciliated

canal. Paired atria consists of two parts: an anterior contorted, glandular one with a narrow cavity, and a succeeding expanded non-glandular distal part with a large cavity and a high columnar epithelium. Atria and pyriform paratrium with a cap of prostatic cells at the proximal end open into unpaired copulatory pouch. No spermathecae. (53)

Seminal vesicle (unpaired) begins from dissepiment X/XI and extends up to segment XXX.

Reproductive system may be displaced anteriorly by 2 segments (testes in segment VIII, ovaries in IX, etc.). (54)

Body dimensions:  $l = 28-35$  mm, diameter  $0.3-0.4$  mm,  $S = 78-140$ .

The species is still a question mark, as only immature specimens are available to us.

**Occurrence.** Kamchatka R. basin (Lake Kenuzhen); warm mud in the Uzon caldera, a creek; hot bath springs in the upper part of the Bystraya R.; Lake Nachikinskoye.

The species is rare in Kamchatka (only 37 specimens found). As a rule, B. vej dovskyanum was encountered in warm waters ( $t = 18-21.4^{\circ}\text{C}$ ), in Lake Nachikinskoye ( $14.9-15.8^{\circ}\text{C}$ ). In lakes, this species was found at a depth of  $1.2-1.7$  m, on silty (with detritus), sandy and clayey (with pumice particles) substrates.

**Geographic distribution.** Europe, Far East (Primor'ye, Kamchatka), Sino-Indian Region, Nearctic Region, Africa (discontinuous range).

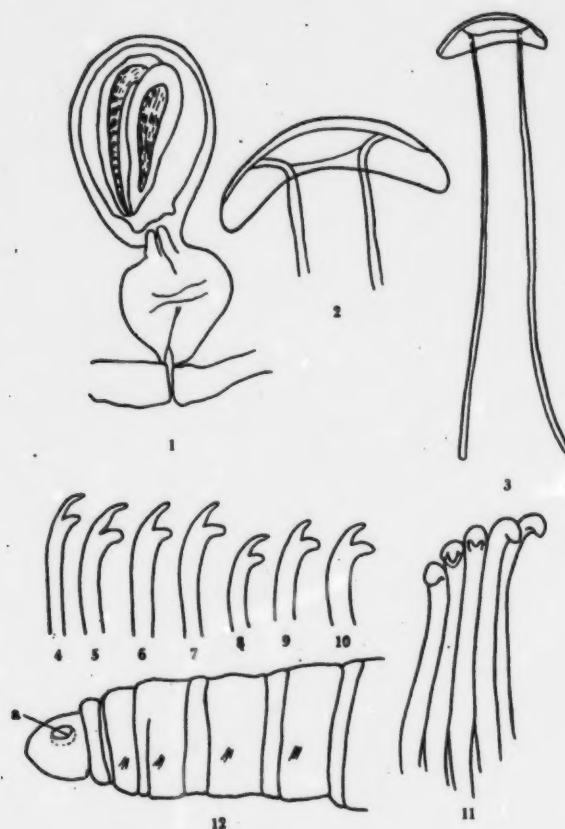


Fig. 6. Limnodrilus helveticus Piguët (1-3) and Bothrioneurum vej dovskyanum Stolc (4-12):

1 - spermatheca (x200); 2 - distal part of penial tubule (x600); 3 - penial tubule (x400); 4, 5, 6, 7 - dorsal setae of segments II, IV, VII, XII; 8, 9, 10 - ventral setae of segments II, XVI, XVIII; 11 - bundle of penial setae (x1350); 12 - anterior region of body with ciliated pit on prostomium (a)

**Subfamily Tubificinae Eisen, 1895**

Genus Tubifex Lamarck, 1816

Tubifex hrabei Sokolskaja, 1973

(fig. 7)

Sokol'skaya, 1973a: 58-61, fig. 3-4.

**Description.** Small worms with a very thin caudal region. Prostomium short, rounded (length noticeably smaller than width of base) or conical, with a rounded apex (length approximately equal to width of base). Anterior segments with secondary annulation (number of rings varies). Ventral bundles of anterior

(preclitellar) segments contain 2-6 forked setae with distal tooth longer and thinner than proximal one, with distal nodule, and length of 73-91  $\mu\text{m}$ . Setae shorter on segment II. Behind clitellum number of setae per bundle decreases to 2-1, and their length to 64  $\mu\text{m}$ , teeth become sharper. Dorsal bundles of anterior segments with 2-5 hairlike, basally plumose setae 230-440  $\mu\text{m}$  long, and 2-4 fan-shaped setae with distal nodule and length of 64-94  $\mu\text{m}$ ; fan-shaped setae with wide marginal teeth and (1) 2-3 parallel intermediate denticles. Behind clitellum size of setae and their number per bundle decrease (to 1-2) and fan-shaped setae are replaced by forked setae similar to ventral ones, with a long distal tooth and several thin accessory denticles. No genital setae.

Clitellum on segments 1/n X—XII. One pair of male pores in place of ventral setae of segment XI. One pair of spermathecal apertures on segment X in front of and slightly laterad ventral bundles. (55)

Pharynx and chromophil cells in segments II and III. Chloragogue tissue covers intestine from segment VI. Postseptale of anterior nephridium in segment V. Annular blood vessels of segment VIII transformed into "hearts". Vasa deferentia long, forming loops; canal lined with ciliated epithelium throughout, diameter gradually increases from 18-21  $\mu\text{m}$  in proximal part to 27-30  $\mu\text{m}$  in distal part. Vasa deferentia enter atria apically. Atrium long (470-520  $\mu\text{m}$ ), narrows slightly distally and more abruptly proximally. No ejaculatory duct. Conical penis in penial sheath with a funnel-shaped cuticular penial tubule, one pair of spermathecae with a large oviform ampulla, without a duct, and with a thickened wall around the spermathecal pore. Spermatozoa large, vermiform. (56)

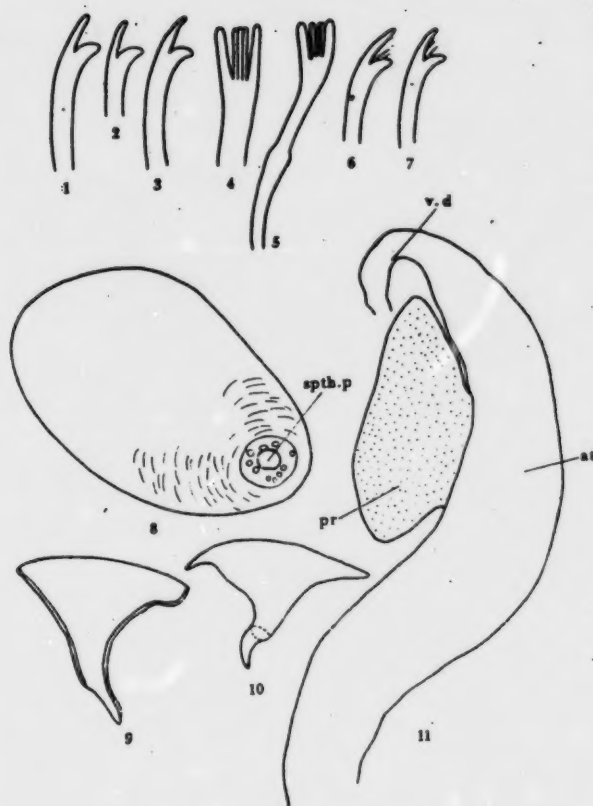


Fig. 7. Tubifex hrabei Sokolskaja:

1, 2 - ventral setae of anterior segments; 3 - ventral seta of posterior segment; 4, 5 - dorsal fan-shaped setae of segments IV and VIII; 6, 7 - dorsal forked setae behind clitellum (x1350); 8 - spermatheca (x280); 9, 10 - penial tubules of 2 specimens (from different angles, x600); 11 - part of male gonoduct (x400) (at - atrium, pr - prostate, v.d. - vas deferens, sph. p - spermathecal pore)

Seminal vesicle paired: anterior ones extend from dissepiment IX/X into the cavity of segment IX, posterior ones extend from dissepiment X/XI to segment XIV. Ovisacs go into segment XV.

Body dimensions: l = 18 mm, maximum diameter 0.5-0.6 mm, S = 66-97.

**Occurrence.** Kamchatka R. basin (Lake Azabach'ye and the B. Kurarochnyi spring); Lake Kronotskoye; Utkha R. (Domashniy spring); Lake Nachikinskoye. Koryak upland: Lake Potatgytkhyn.

The species was found at a depth of 9-124 m, on a silty, silty-sandy, or sandy bottom, sometimes with plant remains. Mature specimens were encountered (during different years) at the beginning of May and end of June (in springs), and in July, August, September and October (in lakes).

T. hrabei is apparently related to the Lake Onega T. kessleri Hrabe (Sokol'skaya, 1973a).

Geographic distribution. Kamchatka and Koryak upland.

Tubifex kessleri Hrabe, 1962 subsp. americanus  
Brinkhurst et Cook, 1966  
(fig. 8)

Brinkhurst and Cook, 1966: 13, fig. 6 B-E; Brinkhurst and Jamieson, 1971: 460, fig. 8, 2 L-O; Sokol'skaya, 1973a: 61-64, fig. 5-6.

**Description.** Prostomium short, rounded. Anterior segments with secondary annulation. Ventral setae of anterior (preclitellar) segments forked, with distal tooth longer and thinner than proximal one and with distal nodule, 3-4 in a bundle; usually one, less commonly 2-3 intermediate denticles present, but sometimes absent altogether. Number of setae per bundle decreases to 2-3 behind clitellum, and to 2 in caudal region. Dorsal bundles of anterior region of body contain 3-4 plumose hairlike setae and 3-4 fan-shaped ones with 2-4 thin median denticles and a distal nodule; dorsal bundles of posterior segments each contain one hairlike and one fan-shaped seta. No genital setae. (57)

Clitellum on segments X-XI. One pair of male pores in place of ventral setae of segment XI. One pair of female pores in intersegmental furrow XI/XII; one pair of spermathecal pores on segment X, on line of setae laterad ventral bundles.

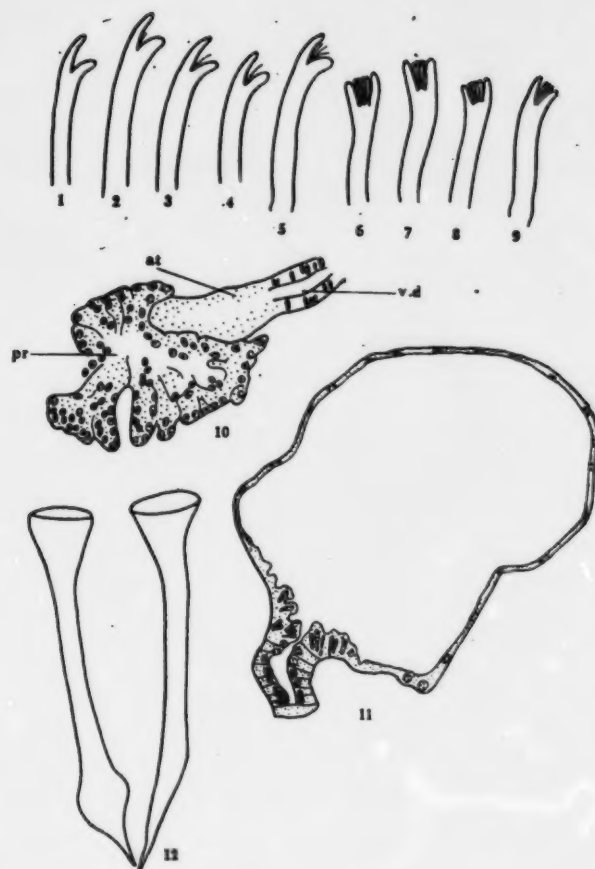


Fig. 8. Tubifex kessleri americanus Brinkhurst et Cook:

1, 2, 3, 4, 5 - ventral setae of segments II, V, VI and VII; 6, 7, 8, 9 - dorsal fan-shaped setae of segments III, IV, V, and posterior segment (x1350); 10 - connection between vas deferens and atrium (x200); 11 - spermatheca (x280); 12 - penial tubule of a specimen (x600) (at - atrium, pr - prostate, v.d. - distal part of vas deferens)

Pharynx in segments II-III, chromophil cells in segments II-IV. Chloragogue tissue covers intestine from segment VI. Postseptale of anterior nephridium in segment VI. Annular vessels of segment VIII transformed into "hearts".

Vasa deferentia about three times as long as atria. Thin (18-21  $\mu$ m) and contorted proximal region of vas deferens with ciliated lining of canal passes into much thicker (38  $\mu$ m) distal region with a thick wall without ciliated epithelium: vas deferens

falls into atrium apically. Atrium spindle-shaped, narrows noticeably proximally (to 32-34  $\mu$ m) and especially distally (to 20  $\mu$ m), maximum diameter at point of entry of prostate (46-50  $\mu$ m). Penis conical, in penial bursa. Cuticular penial tubule long (113-115  $\mu$ m), infundibularly expanded in proximal part, cylindrical in middle and tapered distally, with lateral opening. Spermathecae with large sacciform ampulla and short (84  $\mu$ m) duct. One pair of posterior seminal vesicles from dissepiment X/XI to segment XII. Ovisacs go into segment XIV.

Body dimensions: l = 18-22 mm, diameter < 1.0 mm, S = 71-75.

We believe that it would be possible to accept and validly confirm the rank of this taxon only after studying the series of worms of T. kessleri Hrabe from Lake Onega, described from a single specimen.

**Occurrence.** Lake Azabach'ye; Lake Nichikinskoye.

Encountered at a depth of 11-31 m on a silty bottom, silt with sand, or clay with pumice particles. Mature worms noted from mid July to 20 August (during different years).

**Geographic distribution.** North America (Lake Superior and Lake Michigan), Kamchatka.

Genus Ilyodrilus Eisen, 1879

Ilyodrilus templetoni (Southern, 1909)

(fig. 9; 3-8)

Southern, 1909: 140, Pl. VIII, fig. 6A-E (Tubifex); Sokol'skaya, 1964a: 84-89, fig. 1-5 (Tubifex lastockini); Hrabe, 1965: 61-65, figs. 9-19 (Ilyodrilus); Sokol'skaya, 1972b: 79-80.

**Description.** Prostomium small, conical, with rounded apex. Anterior segments (I-V) biannulate, anterior ring narrower than

setiferous posterior one; secondary rings break up into tertiary ones from segment VI. Ventral bundles of anterior segments contain 3-5 forked setae with distal tooth longer and thinner than proximal one and with distal nodule. Behind clitellum ventral setae have shorter distal tooth and their number per bundle decreases. Dorsal bundles of anterior segments each contain 2-6 flexible hairlike setae about as long as body diameter, and 2-5 fan-shaped setae with equal marginal teeth and 2-5 thin median denticles. Dorsal bundles behind clitellum consist of 1-2 hairlike and 1-2 forked setae with longer and thinner distal tooth. No genital setae.

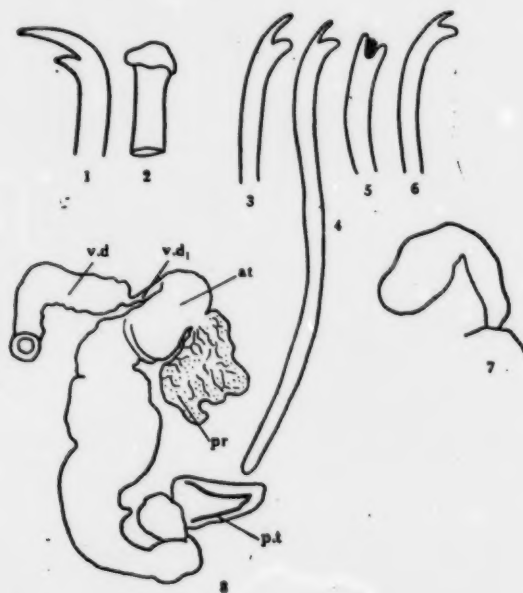


Fig. 9. Limnodrilus udekemianus Claparède (1-2) and Ilyodrilus templetoni (Southern) (3-8):

1 - ventral seta of anterior segment (after O.V. Chekanovskaya, 1962);  
2 - penial tubule (after Brinkhurst, 1965); 3, 4, 6 - ventral setae of  
segments II, III and posterior segment; 5 - dorsal fan-shaped seta of  
anterior segment (x900); 7 - spermatheca; 8 - part of male gonoduct (x200)  
(at - atrium, pr - prostate, v.d. vas deferens; p.t. - penial tubule in  
penial bursa)

Clitellum on segments 1/n X-XII. One pair of male pores in place of absent ventral setae of segment XI; one pair of female pores in intersegmental furrow XI/XII; one pair of spermathecal pores on segment X in front of ventral bundles of setae. (60)

Pharynx reaches segment V; chloragogue tissue covers intestine from segment VI. Annular blood vessels expanded in segments VIII and IX.

One pair of testes and sperm funnels in segment X, one pair of ovaries and egg funnels in segment XI. Length of vasa deferentia less than length of atrium and penis. Vas deferens not very contorted, wide (38-42  $\mu$ m), with a canal lined with ciliated epithelium; before entering atrium (subapically) it forms a short narrow neck. One pair of tubular atria with a somewhat expanded proximal part. Large prostate falls into proximal part of atrium. Penis retractile, with conical cuticular penial tubule, up to 100  $\mu$ m long. One pair of spermathecae in segment X, with oviform ampulla and a duct equal in length or longer than the ampulla.

Body dimensions: l = 6-14 mm, S = 40-70.

**Occurrence.** Kamchatka R. basin (Lake Soldatskoye); Lake Kronotskoye; Khairyuzovaya R. basin.

The species was encountered mostly on a silty substrate with a mixture of sand. I. templetoni is quite rare in the European part of the USSR. According to our data, it is common in the lakes of southern Sakhalin, and is known on Kunashir Is.

**Geographic distribution.** Holarctic Region.

Genus Ilyodriloides Sokolskaja, gen. n.

Type species: Ilyodriloides potatiensis, sp. n.

**Diagnosis.** Dorsal bundles contain hairlike and fan-shaped or forked setae; ventral bundles consist of forked setae. Atrium long, tubular, contorted, expanded in proximal part, passes into long contorted ejaculatory duct, gradually narrows in distal direction. Vas deferens wide, barely contorted, much shorter than atrium and ejaculatory duct with penis. Compact prostate falls into proximal part of atrium behind entry of vas deferens. Penis retractile, in penial bursa with cuticular penial tubule. Sperm formed into spermatzeugmata. All parts of reproductive system paired.

Distinguished from Ilyodrilus Eisen by presence of tubular, very long ejaculatory duct with thick walls and narrow lumen. Structure of vas deferens and atrium similar to indicated genus.

(61)

Ilyodriloides potatiensis Sokolskaja, sp. n.

(fig. 10)

**Diagnosis.** Small worms with sharply tapering caudal region of body. Prostomium small, spherical or conical. Anterior segments with several secondary rings (4-5). Dorsal bundles of anterior segments contain 4-6 smooth hairlike setae and 4-6 forked setae with wide teeth (distal tooth narrower than proximal one) and 1-2 thin intermediate denticles, nodule distal. Dorsal forked setae behind clitellum similar to ventral ones in the form of the distal end, intermediate denticles disappear, 2-3 in a bundle. Ventral setae with similar distal end in all regions of the body: distal tooth longer and thinner than proximal one, nodule distal; anterior segments with 5-6 thin setae in a bundle, posterior ones

(62)

with 2-3 more curved setae. No genital setae. One pair of spermathecal pores on segment X, on line of ventral setae not far from posterior intersegmental furrow. One pair of male pores on segment XI in front of ventral setae on line of ventral bundles or slightly more laterad.

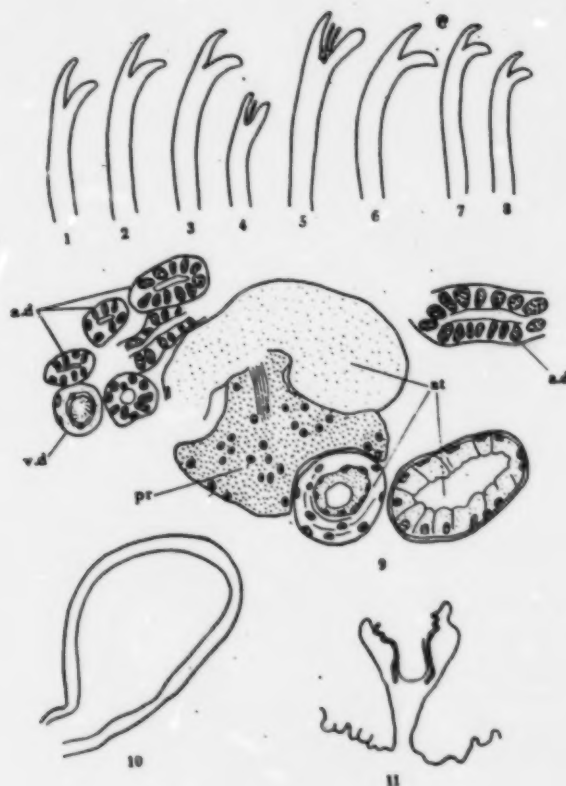


Fig. 10. *Ilyodriloides potatiensis*, sp. n.

1, 2, 3 - ventral setae of segments VI, VII and caudal segment; 4-8 - dorsal forked setae of III, V, XV and caudal segments (x1800); 9 - part of male gonoduct (x400); 10 - spermathecal ampulla (x200); 11 - penial bursa with penis and penial tubule (x300) (at - atrium, ad - atrial duct, pr - prostate, v.d. - vas deferens)

Pharynx in segments II-III, chromophil cells in segments (II) III-IV. Chloragogue tissue of intestine begins in segment VI.

One pair of testes in segment X and one pair of ovaries in segment XI, one pair of large discoid sperm funnels on anterior surface of dissepiment X/XI. Vas deferens quite wide, hardly contorted, with a wide canal lined with ciliated epithelium throughout, falls into atrium apically, considerably shorter than the rest of the male gonoduct. Atrium long, tubular, proximally expanded, contorted, passes into long and contorted ejaculatory duct with thick walls and a narrow lumen. Retractable cylindrical penis present, in penial bursa. Cuticular penial tubule pot-shaped. Penis receives narrow thin-walled part of ejaculatory duct.

One pair of spermathecae with oviform ampulla and long duct expanded distally. Spermatozeugmata vermiform.

Seminal vesicle unpaired, begins from dissepiment X/XI and goes into segment XV, ovisac reaches segments XVII-XVIII.

Body dimensions:  $l = 11-16$  mm, diameter in region of clitellum about 0.7 mm,  $S = 74-82$ .

Geographic distribution. Koryak upland (Lake Potatgytkhyn).

Holotype stored in collection of Zoological Museum of Moscow State University, No. 0-1257.

**Description.** Small worms with sharply tapering caudal region of body. Prostomium small, spherical or conical. Anterior segments with several (4-5) secondary rings. Dorsal bundles of anterior (preclitellar) segments contain 4-6 smooth hairlike setae (63) 237-455  $\mu$ m long and 4-6 forked setae 73-82  $\mu$ m long with a weakly defined distal nodule (located of nodule determined by ratio 6:11, 6:13); teeth of setae wide, distal tooth usually narrower than proximal one, 1-2 thin intermediate denticles present.

Dorsal forked setae behind clitellum more curved, with a distal tooth similar to ventral setae, intermediate denticles disappear, nodule distal (7:10). Ventral setae with same distal end in all regions of body; anterior segments with thin, weakly S-shaped setae, with longer and thinner distal tooth and distal nodule (8:15), 99-103  $\mu\text{m}$  long, 5-6 in a bundle. Ventral setae behind clitellum more curved, about 86  $\mu\text{m}$  long, with distal nodule (8:12).

Number of all types of setae and their length decrease caudally. No ventral setae noted on segment X; 2-3 setae of usual form in ventral bundles on segment XI.

Clitellum flat, indistinctly delimited. One pair of spermathecal pores on segment X, on line of ventral setae not far from posterior intersegmental furrow. One pair of male pores on segment XI in front of ventral setae on line of ventral bundles or slightly more ventrad.

Pharynx in segments II-III, chromophil cells in segments (II) III-IV. Oesophagus occupies segments IV-VI and anterior third of segment VII. Mid-intestine begins from second third of segment VII. Chloragogue tissue begins from dissepiment V/VI. Nephridia and contractile "hearts" not detected.

One pair of testes extends from dissepiment IX/X in segment X, one pair of ovaries in segment XI, extends from dissepiment X/XI. One pair of large sperm funnels (dorsoventral diameter 198  $\mu\text{m}$ ) attached to anterior surface of dissepiment X/XI. Vas deferens quite wide, same diameter (about 35  $\mu\text{m}$ ) throughout, 547-595  $\mu\text{m}$  long, hardly contorted, with a wide canal (18-22  $\mu\text{m}$ ) and long, fairly thick cilia, falls into atrium apically. Atrium tubular,

expanded in proximal part (diameter 69-73  $\mu\text{m}$ ) and tapers distally (52-43  $\mu\text{m}$ ), contorted. Atrium passes into long contorted efferent part, the ejaculatory duct. Efferent part narrows somewhat from proximal (diameter 43-47  $\mu\text{m}$ , thickness of wall 21  $\mu\text{m}$ ) to distal end. Large part of ejaculatory duct 35  $\mu\text{m}$  in diameter, with walls 13  $\mu\text{m}$  thick and lumen about 8  $\mu\text{m}$  wide. Vasa deferentia intersecting cavity of segment XI much shorter than the rest of the gonoduct; (64 atria located in segments XI-XIII, efferent part returns from segment XIII into segment XI. Cylindrical retractile penis receives narrow (17  $\mu\text{m}$ ), thin-walled (4.3  $\mu\text{m}$ ) distal part of ejaculatory duct. Penial bursa big. Penis in cuticular penial tubule shaped like a pot or jug, 56-82  $\mu\text{m}$  long with maximum diameter (in distal half) of 43-47  $\mu\text{m}$ . One pair of spermathecae with oviform ampulla and long duct about 39  $\mu\text{m}$  in diameter. Distal part of duct expanded (69  $\mu\text{m}$ ), inner wall forms horizontal folds. Spermathecal ampullae asymmetrical (in segment X in one half of body, in segment XI in the other half). Sperm in the form of vermicular spermatozeugmata. Seminal vesicle unpaired, begins from dissepiment X/XI and enters segment XV, ovisac reaches segments XVII-XVIII.

Body dimensions:  $l = 11-16$  mm, diameter in clitellar region about 0.7 mm,  $S = 74-82$ .

**Occurrence.** Koryak upland, Lake Potatgytkhyn, depth 3.2-5.1 m, substrate - sand with pebbles and silty sand with plant remains (collected by I.I. Kurenkov, 10 and 17 September 1965, 136 specimens in all, 24 mature ).

Holotype found in Lake Potatgytkhyn, on silty sand with plant remains, at a depth of 5.1 m (collected by I.I. Kurenkov, 17 September 1965).

Genus Spirosperma Eisen, 1879

Subgenus Spirosperma s. str.

Spirosperma (Spirosperma) apapillatus  
(Lastochkin et Sokolskaja, 1953)  
(fig. 11)

Lastochkin and Sokol'skaya, 1953: 411-412, fig. 2 (Peloscolex); Sokol'skaya, 1964: 90, fig. 6 (P. apapillatus f. sachalinensis); 1961: 56-59, fig. 2 (P. kamtschaticus); 1972b: 82, fig. 3 (P. kamtschaticus); Holmquist, 1978: 189, 195, 196 (Spirosperma); 1979: 47-48, figs. 11-12 (Spirosperma).

**Description.** Body light gray, sometimes with brownish hue; integument of secretion and foreign particles thin, does not form regular bodies; very thin fine-grained particles concentrated mainly in intersegmental furrows and grooves of secondary rings, giving body surface annular pattern. Number of rings increases from 2-3 in anterior segments to 10-16 behind segment VI. Fine-grained structure sometimes absent and body surface is smooth, with annular thickenings. Epidermal sensory papillae sparse, (65) small, oval, and found only in posterior region of body. Ventral bundles of anterior segments contain 3-6 forked setae with distal tooth longer and thinner than proximal one and with a slightly distal (almost median) nodule. Beginning from segments VII-VIII ventral setae become larger and length of teeth evens out; setae (66) behind clitellum large (length 130-175  $\mu$ m, thickness 8-11  $\mu$ m), with a long thick proximal tooth and a short thinner distal tooth. Dorsal bundles of anterior segments contain 3-7 smooth sabre-shaped hairlike setae up to 400  $\mu$ m long and 3-4 fan-shaped setae with equal marginal teeth and 2-4 thin intermediate denticles. No genital setae.

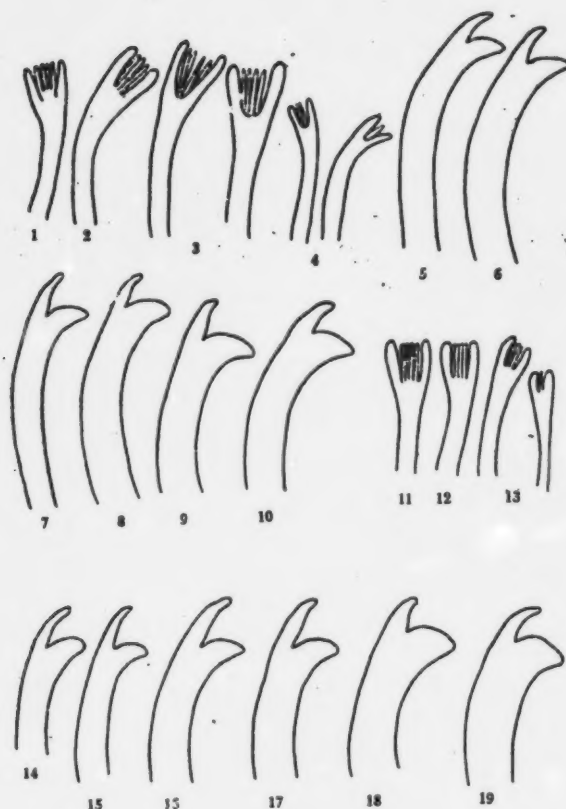


Fig. 11. Spirosperma (Spirosperma) apapillatus  
(Lastochkin et Sokolskaja):

1-10 - specimen from Kamchatka; 1-4 - dorsal fan-shaped setae of segments III, VII, VIII and caudal segment; 5-10 - ventral setae of segments II, III, VII, XVII, XXII and XXIII; 11-19 - specimen from Amur Basin (syntype); 11-13 - dorsal fan-shaped setae of segments IV, VII and caudal segment; 14-19 - ventral setae of segments II, III, IV, XXV and XXVI (x1350)

Clearly defined clitellum on segments X-XII. One pair of male pores in place of ventral bundles of setae on segment XI. One pair of females pores in intersegmental furrow XI/XII. One pair of spermathecal pores on segment X in front of or behind ventral bundles of setae, may be laterad line of ventral setae in the first case.

Vas deferens long and contorted, with ciliated canal, gradually expands distally falls into atrium apically. Atrium tubular,

curved, narrows towards ends, relatively long, with a high glandular ciliated epithelium. Large prostatic gland opens into central concave part of atrium. Ejaculatory duct long and contorted. Penis in penial bursa, large, with thick penial tubule which leaves its distal end free. Spermathecae with large ovi-form ampulla and long duct (700-800  $\mu$ m) about 200  $\mu$ m thick. Spermathecal duct well delimited from ampulla, spirally curved in middle part. Spermatozeugmata long, vermiform.

Body dimensions:  $l = 17-25$  mm, diameter in region of clitellum 0.6-1.3 mm  
 $S = 60-85$ .

In the description of P. kamtschaticus, its similarity to P. apapillatus is noted. The features differentiating these species are the form of the spermathecae, the location of the spermathecal apertures (behind the ventral bundles of setae on segment X in P. kamtschaticus, in front of and slightly more laterad the same bundles of setae in P. apapillatus), and the absence of a cuticular covering of the penis in the first species. Having studied several specimens of P. kamtschaticus and P. apapillatus, S.A. Hrabe (1964) acknowledged the independence of these species, differentiating them on the basis of the size of the ventral setae and the location of the spermathecal pores. Without any sufficient motive, R. Brinkhurst (Brinkhurst, Jamieson, 1971) declared P. apapillatus and P. kamtschaticus as subspecies of P. tenuis Hrabe, 1931, described from lakes Okhrida and Prespa in Yugoslavia by Hrabe, 1931). Having examined specimens of P. apapillatus and P. kamtschaticus, Ch. Holmquist expressed the opinion that these species were identical, indicating that the spermathecal pores in the specimens available to her were found in front of the ventral setae of segment X and that a cuticular penial tubule was observed in all the cases (Holmquist, 1978, 1979).

Having re-examined the P. kamschaticus specimens from the collection of the Zoological Museum of Moscow State University and compared them with the syntypes of S. (S.) apapillatus (Amur Basin), we came to the following conclusions: both are characterized by the presence of a cuticular penial tubule; the location of the spermathecal pores varies in both the Kamchatka and the Amur worms (in both there were specimens with spermathecal pores located "anterior" and "posterior" to the ventral bundles of segment X); with the "anterior" location of the pores, they were sometimes displaced to the side (slightly laterad the line of ventral setae). The noted variations in the form of the spermathecal ampulla of the Kamchatka and Amur worms should be attributed to different stages of development and fullness.

The above data permit us to regard P. kamschaticus as a synonym of S. (S.) apapillatus, noting some of the characteristics of the Kamchatka population of the species. The ventral setae of the Kamchatka worms are smaller (shorter and thinner); their maximum size (in the middle part of the body) is about 130  $\mu\text{m}$  in length and 8  $\mu\text{m}$  in thickness. The maximum size of the ventral setae in the Amur worms is 175  $\mu\text{m}$  (length) and 11  $\mu\text{m}$  (thickness). The ventral setae in the caudal region of the body are 5  $\mu\text{m}$  thick in the Kamchatka worms, and up to 9  $\mu\text{m}$  thick in the Amur worms. Only biometric processing of extensive material will tell us whether these differences are sufficient for establishing the Kamchatka worms as a separate subspecies.

Occurrence. Kamchatka R. basin (lakes Eul'chinok, Dvukhyurtochnoye, Kharchinskoye, Klyuchevskoye, Sobach'ye, Kurarochnoye, Kenuzhen, Katlanach, Azabach'ye and Soldatskoye; Soldatskaya R. - source); Lake Kronotskoye; Lake Nachikinskoye; Lake Tolmachevskoye; hot bath springs in the upper part of the Bystraya R.; Lake Maloye Zuikovskoye; Lake Kambal'noye. Koryak upland: Lake Maloye Kultuchnoye.

The species is widely distributed in the lakes of Kamchatka. In addition to lakes, it was noted only once in hot bath springs (2 specimens) and in the source of the Soldatskaya R. It was encountered at depths from 0.3 to 60 m, mainly on silty and sandy substrates, in some cases on sand mixed with pebbles and on stones (single specimens). Mature specimens were noted from 1 June, in July and August, and during the first ten days of October (during different years).

Geographic distribution. Amur R. basin (middle and lower part), Primorsky krai (Maritime Territory), Kamchatka, Koryak upland, Sakhalin Is.

Subgenus Embolocephalus Randolph

Spirosperma (Embolocephalus) kurenkovi (Sokolskaja, 1961)  
(fig. 12)

(69)

Sokol'skaya, 1961: 59-61, fig. 4 (Peloscolex); 1972b: 80-82, fig. 2 (Peloscolex); Holmquist, 1978: 189, 201, 203 (Embolocephalus); 1979: 44-45, figs. 8-9 (Embolocephalus).

Description. Body dark gray, sometimes rust-brown on anterior and posterior ends, covered with a layer of secretion and foreign particles which forms papillate structure, smaller and denser in anterior segments, larger and sparser in succeeding ones. Epidermal sensory papillae arranged annularly in 2 rows on segment, on line of setae and in intersegmental furrow, usually concealed by integuments. Prostomium, segment I and part of segment II retractile. Ventral setae slender, mostly forked, with blunt teeth; on anterior segments with distal tooth longer and slightly thinner than proximal tooth, 2-3 in a bundle; both forked setae and edentate ones found in ventral bundles on segments II, III and sometimes IV. Number of ventral setae per bundle decreases caudally, distal tooth becomes shorter and much smaller than proximal tooth. Spermathecal setae solitary, with gland, almost straight and slightly expanded in distal third, 250-287  $\mu\text{m}$  long with base about 4  $\mu\text{m}$  thick. Dorsal bundles contain up to 3-4 smooth sabre-shaped hairlike setae (on anterior segments) and up to 2-3 thin

thin and fairly short (50-60  $\mu$ m) fan-shaped setae with almost equal marginal teeth and 1-3 median denticles (sometimes absent).

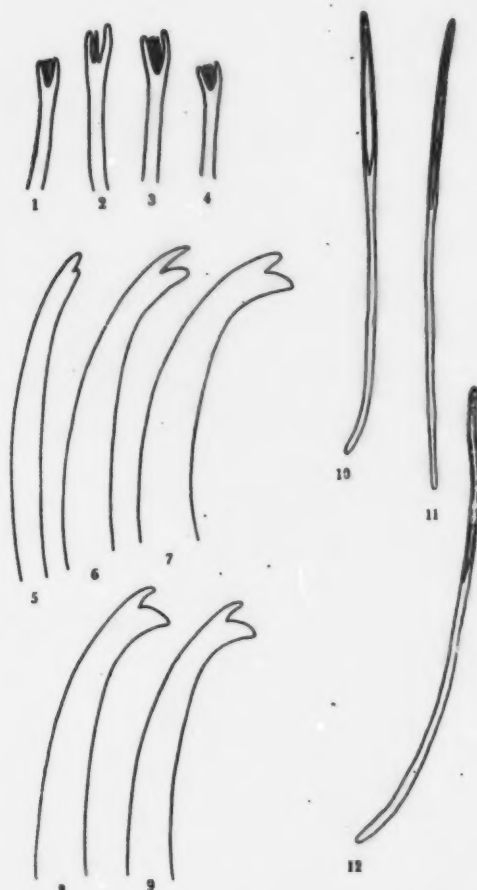


Fig. 12. Spirosperma (Embolocephalus) kurenkovi (Sokolskaja):

1-4 - dorsal fan-shaped setae of anterior segments; 5-9 - ventral setae of segments III, IX, XXII and posterior segments (xl350); 10-12 - spermathecal setae of different specimens

Clitellum sharply delimited, muff-shaped, on segments X-XII. One pair of male pores in place of ventral setae of segment XI. One pair of female pores in intersegmental furrow XI/XII. One pair of spermathecal pores on line of setae of segment X closer to lateral line than to line of ventral setae.

Vas deferens very long and contorted, with ciliated canal throughout, narrow proximal part quite sharply passes into distal part twice as wide,

falls into atrium apically. Atrium tubular, curved, narrows towards ends, with high glandular, non-ciliated epithelium. Prostatic gland large, falls into atrium entally from its middle. Ejaculatory duct short, more or less included in proximal part of penial apparatus. Penis in penial bursa, long, slightly tapering distally. No cuticular penial tubule. Spermathecae (full) with long sacciform or sausage-like ampulla up to 1.0-1.5 mm long and 227-500  $\mu$ m in diameter. Spermathecal ducts well delimited from ampullae, long (up to 1.2 mm) and relatively narrow (100-105  $\mu$ m), with thick walls with the characteristic cross-striation, and with a narrow canal. Spermatozeugmata long and narrow. (70)

Body dimensions: length about 20 mm, diameter in clitellar region 1.2 mm; S = 63-70.

Occurrence. Kamchatka R. basin (lakes Klyuchevskoye, Azabach'ye and Soldatskoye; Soldatskaya R. - source); Khairyuzovaya R. basin (Tikhaya R. and other water bodies); Lake Kronotskoye; Lake Nachikinskoye; Lake Tolmachevskoye; Dal'nyaya R. - source; hot bath springs in upper part of Bystraya R.; Plotnikov R.; Lake Kambal'noye.

This is one of the most abundant and common species on the peninsula, confined mainly to lakes where it is encountered at depths from 1 to 60 m on silty, sandy-silty substrates, less commonly on sand, and in some cases sand mixed with pebbles. The species is not common in rivers (encountered in two cases at river outflows from lakes), in shallow water (depth 0.4-1.0 m) and on a stony bottom. Mature specimens have been encountered (during different years) from the end of May up to October.

In the opinion of Holmquist (1979) who has thoroughly examined whole-mount preparations and series of sections, S. (E.) kurenkovi is very similar to two North American species, S. (E.) alaskana (Holmquist, 1979) and S. (E.) confusus (Holmquist, 1979). The first was encountered in four lakes of Northern Alaska,

while the second is definitely exclusive to the Great Lakes. S. (E.) kurenkovi is distinguished from the indicated species by partial inclusion of the ejaculatory duct in the proximal part of the penial apparatus and its length, as well as by the bluntness of the teeth of the ventral setae. The Kamchatka species and S. (E.) alaskana also differ in the length of the atrium and spermathecal duct, and in the form of the dorsal toothed setae.

Geographic distribution: Kamchatka.

Subgenus Orientodrilus Holmquist

Spirosperma (Orientodrilus) nikolskyi (Lastochkin  
et Sokolskaja, 1953)  
(fig. 13)

Lastochkin and Sokol'skaya, 1953: 409, fig. 1 (Peloscolex); Sokol'skaya, 1972b: 82-83, fig. 4 (Peloscolex sp.); 1973a: 64, fig. 7; Holmquist, 1978: 189, 195, 197, 201, 205, 206, figs. 3A, 7D, 9F (Orientodrilus); Holmquist, 1979: 49, fig. 15 (Orientodrilus).

Description. Body gray, often with brown hue, sometimes rust-brown, covered with a layer of secretion and foreign particles which form oval bodies. Epidermal sensory papillae arranged annularly in 2 rows on segment, sparse, hidden by integuments. Prostomium and at least anterior segment retractile. Ventral bundles of anterior segments contain 2-5 forked setae with distal tooth longer and thinner than proximal one, with almost median nodule; 1-2 edentate setae encountered together with forked ones on segments II and III. Ventral setae behind clitellum very large, highly S-shaped, with large proximal tooth and a short thinner distal tooth, 1-2 in a bundle. Spermathecal setae solitary, with gland, straight, slightly expanded and trough-shaped in distal third, 170-270  $\mu$ m long. Dorsal bundles of anterior segments contain 3-7 smooth sabre-shaped hairlike setae and several fan-shaped ones with almost equal marginal teeth and 1-5 thin intermediate denticles (absent in exceptional cases).

Clitellum well delimited, high, on segments X-XII. One pair of male pores in place of ventral bundles of setae on segment XI. One pair of female pores

in intersegmental furrow XI/XII. One pair of spermathecal apertures on segment X, function jointly with opening of sac of spermathecal setae.

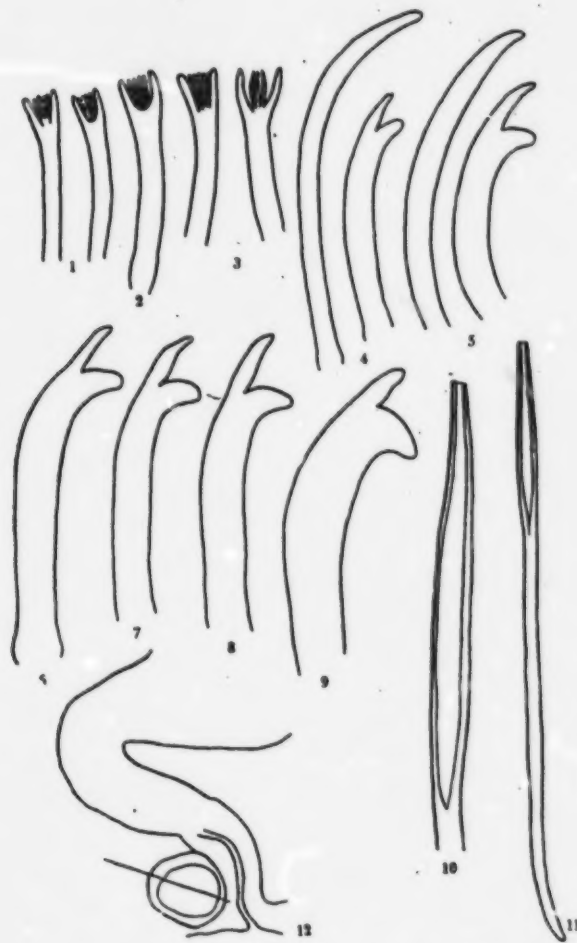


Fig. 13. Spirosperma (Orientodrilus) nikolskyi (Lastochkin et Sokolskaja):  
1-3 - dorsal fan-shaped setae of segments II, III and IV; 4, 5 - ventral setae of segments II and III; 6-9 - ventral setae of segments IV, V, VI and XX;  
10 - distal end of spermathecal seta (x1350); 11 - spermathecal seta (x600);  
12 - spermathecal duct and pore and spermathecal seta (x150)

Vas deferens long and contorted, with ciliated epithelium throughout, divided into two parts, a narrow proximal one and a wide distal one, falls into atrium apically. Atrium crescent-shaped. Atrial wall with well-developed muscular layer and high glandular non-ciliated epithelium. Prostatic gland

falls into concave part of atrium. Ejaculatory duct long, with muscular layer in wall, non-ciliated. Penis in penial bursa, large. No penial tubule. Spermatheca with elongated ampulla and well-delimited fairly wide duct of average length. Spermatozeugmata long and thin.

Body dimensions: length 20-40 mm, diameter in clitellar region 1.0-1.5 mm; S = 55-90.

Occurrence. Lake Palanskoye, spring; Palana R, Khairyuzovaya R., Tikhaya R. Koryak upland: Lake Chayech'ye (Pakhacha R. basin); Lake Kultuchnoye (Ilirgyt-khyn); Lake Maloye Kultuchnoye.

The species is rare in Kamchatka; it was found only in the northern half of the peninsula (17 specimens found among 10,000 worms) in shallow water (0.2-0.5 m).

Mature specimens have been encountered during the last ten days of July and at the beginning of August (during different years).

Geographic distribution: Amur R. basin (from the sources to the Amur liman), Primorsky krai, Kamchatka, Koryak upland, Sakhalin and Kunashir islands.

(73)

Genus Limnodrilus Claparede, 1862

Limnodrilus udekemianus Claparede, 1862  
(fig. 9, 1-2)

Sokol'skaya, 1961: 55; Chekanovskaya, 1962: 252.

Description. Body pink, with yellowish hue in posterior part. Prostomium conical or turbinate, longer than wide. Anterior segments biannulate, anterior ring wider than posterior one. Ventral and dorsal bundles with similar forked setae, on anterior (preclitellar) segments with a long thick hooked distal tooth and a short proximal one, 5-8 in a bundle; number of setae per bundle decreases to 2 in posterior segments.

Pharynx extends to segment III. Chloragogue tissue covers intestine from segment VI. Cephalic ganglion with deep notches on anterior and posterior margins.

Vas deferens long, atrium bean-shaped, prostatic gland large. Cuticular penial tubule short, ratio of length to width of proximal end 4-5:1. Spermathecae with sacciform ampulla and a long efferent duct.

Body dimensions: length 20-90 mm, S = 160.

Occurrence. Kamchatka R. basin: lakes Azabach'ye and Grob; Dal'nyaya R.; Lake Nachikinskoye.

A species rarely encountered in Kamchatka. Noted at a depth of 0.4-1.7 m on silty sand and pebbles. Mature specimens found in mid July and October (during different years).

Geographic distribution: cosmopolitan species.

Limnodrilus helveticus Piguët, 1913  
(fig. 6; 1-3)

Piguët et Bretscher, 1913: 79, fig. 20; Sokol'skaya, 1957: 310-313, plate 22 and 23; Chekanovskaya, 1962: 252-253, fig. 153A.

Description. Body burgundy red. Prostomium conical, slightly tapered. Anterior segments biannulate, anterior ring narrower than posterior one. Ventral and dorsal setae similar, forked, with distal tooth shorter, longer or equal to proximal one; teeth pointed or rounded. Up to 8 setae in a bundle on anterior (preclitellar) segments, up to 2 on posterior segments.

Clitellum on segments XI-XII. One pair of spermathecal pores in front of ventral setae of segment X.

Pharynx extends to segment III. Chloragogue tissue covers intestine from segment V or VI. Annular vessels transformed into "hearts" in segments VIII-IX. Vas deferens long, falls into atrium apically. Atrium tubular, with large prostatic gland. Cuticular penial tubule 138-340  $\mu$ m long, ratio of its length to width of proximal end varies from 4:1 to 7:1. Spermathecae with spheroid or drop-shaped ampulla and duct forming distal expansion. Spermatozeugmata vermiform. One pair of posterior seminal vesicles extend from dissepiment X/XI up to

(74)

segment XV.

Body dimensions: length 10-50 mm, diameter in clitellar region up to 1.2 mm, S = 50-90.

Occurrence. Kamchatka R. basin (lakes Kamenskoye, Katlanach, Azabach'ye, channel from Lake Grob, Bystraya R., B. Kurarochnyi spring); Lake Kronotskoye; warm mud in the Uzon caldera; Plotnikov R. Koryak upland: Lake Potatgytkhyn.

A fairly common species in Kamchatka, noted in rivers on sandy substrates or sand mixed with pebbles and stones at small depths (0.10-0.50 m), and in lakes predominantly on silty substrates, sometimes with a mixture of sand and small pebbles, at depths from 0.08 to 124 m. Mature specimens have been found from the end of April - in May, June, July, August, September and October (during different years). One mature worm was found in the Bystraya R. on 19 January (1967).

Brinkhurst (1965) has reduced L. helveticus to a synonym of L. profundicolia (Verrill). On the basis of previous considerations (Sokol'skaya, 1972b), we have decided to keep the name L. helveticus for these palearctic worms until a special study of this questions has been carried out.

Geographic distribution: Palearctic Region.

Subfamily Telmatodrilinae Eisen, 1885

Genus Alexandrovina Hrabe, 1962

Alexandrovina ringulata (Sokol'skaja, 1961)  
(fig. 14)

Sokol'skaya, 1961: 61-64, fig. 5 (Peloscolex); Hrabe, 1964: 108 (Alexandrovina); Sokol'skaya, 1972b: 77-78, fig. 1; 1976: 94, fig. 3.

Description. Body light gray (of fixed worms). Prostomium and first segment retractile. Body integuments with cross-striated pattern due to secretion of integuments and particles of earth, dark and light rings alternate. Oval sensory papillae arranged in two transverse rows on segment, on line of setal bundles and near intersegmental furrow. Ventral setae S-shaped, thin; distal

tooth of setae in anterior segments longer and thinner than proximal one, 3-5 setae in bundle; number of setae in bundle in posterior segments decreases to 2, teeth of equal length, but distal tooth thinner. Spermathecal setae 1-2 in a bundle, straight, trough-shaped in distal third, 147-181  $\mu\text{m}$  long and 4.5-6.0  $\mu\text{m}$  wide in distal third. Dorsal bundles on anterior segments contain 5-10 pubescent hairlike setae up to 420  $\mu\text{m}$  long and several thin and short (40-60  $\mu\text{m}$ ) forked needlelike setae. (76)

Clitellum on segments X-XII. One pair of male pores on segment XI; one pair of female pores in intersegmental furrow XI/XII; one pair of spermathecal pores on segment X on line of ventral setae in front of spermathecal setae.

Pharynx in segments II-III, chromophil cells in segments III-IV. Chloragogue tissue covers intestine from segment VI.

Vasa deferentia long and contorted, their diameter gradually increases from 17  $\mu\text{m}$  in proximal part to 38  $\mu\text{m}$  in distal part; fall into atria apically. One pair of tubular looped atria, expanded distally. Up to 16 round or oval prostatic glands fall into atria. Ejaculatory duct short. Penis thick-walled, retractile, in penial bursa. No cuticular penial tubule. One pair of spermathecae with oviform ampulla and well-delimited duct, with cylindrical proximal part and conical distal one. Spermatozeugmata vermiform, long (up to 1.4 mm), with spiral anterior end, diameter 30-50  $\mu\text{m}$ .

Body dimensions: length 14-15 mm, maximum diameter 1.5-2.0 mm, S = 50-54.

Note. The largest worms were incomplete (without the posterior ends), and so the maximum body length and the number of segments in this species are much greater than the ones indicated.

Occurrence. A small lake in the Kayum R. basin; Kamchatka R. basin (Kamchatka R., Bystraya R., Lake Kenuzhen, Prigorodnyi klyuch); Khairyuzovaya R. basin (Bystraya and Tikhaya rivers); Oblukovina R. basin (Tushista spring and

the Izbushechnaya R. spring); Dal'nyaya R.; Krutaya Pad' R.; Karymai (spring tributary of the Bol'shaya R., Utka R. (Domashniy spring). Koryak upland: Pilgovayam R.; Pakhacha R. basin (Lake Chayech'ye); Lake Potatgytkhyn and Lake Khaigytkhyn; Penzhina R.

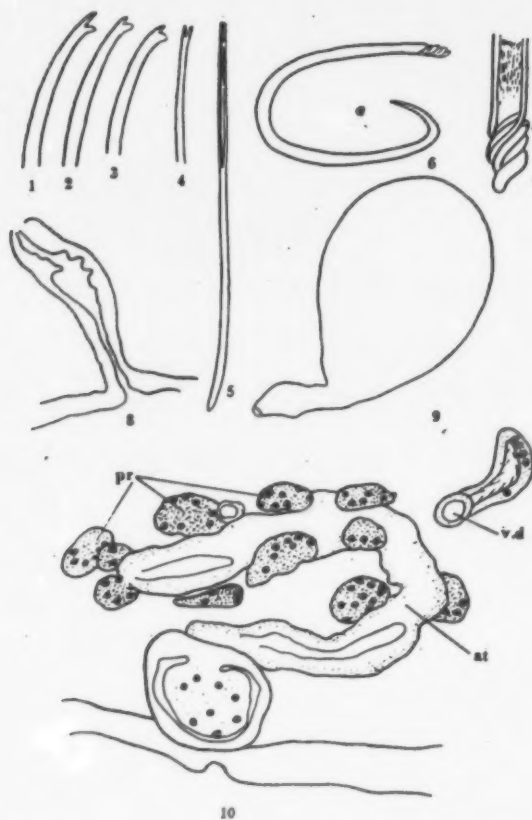


Fig. 14. *Alexandrovia ringulata* (Sokolskaja):

1, 2, 3 - ventral setae of V and posterior segments of body; 4 - dorsal acicular seta; 5 - spermathecal seta (x900); 6, 7 - spermatzeugma and its distal end with high magnification; 8 - spermathecal duct (x200); 9 - spermatheca (x70); 10 - atrium (at), prostatic glands (pr) (x300)

*A. ringulata* has been noted in rivers, springs and lakes on different substrates (silt, silted sand, sand, sand and pebbles, pebbles, stones) and in overgrowths at depths from 0.05 to 98 m. The species has been encountered in shallow waters of the Karymai (depth up to 0.1 m) and a number of rivers and

springs (depth 0.2-0.4 m). It is found deeper in lakes, though it is also encountered in the littoral zone. A. ringulata is found at the greatest depths in Lake Potatgytkhyn where it is noted in all the layers with the maximum numbers being observed at a depth of 2 m (60 specimens in a sample). The numbers (77) of the species then diminish to 3-4 specimens per sample at a depth of 60-98 m.

Mature specimens have been noted in May, June, August and September (during different years). Not quite mature worms have been found on 16 January 1967 in the Bystraya R.

Two species, A. onegensis Hrabe, 1962 and A. ringulata (Sokolskaja, 1961), were assigned to the genus Alexandrovina Hrabe, 1962. Holmquist's review of the A. onegensis specimens from Lake Onega (Holmquist, 1974a) made it possible to alter the diagnosis of the species; it was found that the dorsal bundles contained forked needle setae instead of simple-pointed ones. Therefore, the differences between these taxa were reduced to the pubescence of the hairlike setae and slight variations in the form of the distal end of the spermathecal setae, which is insufficient for separating the species. We regard A. onegensis as a synonym of A. ringulata.

According to A.P. Morev's data (1975) and our own material from Kamchatka, the Koryak upland and the Chukchi Peninsula, the range of A. ringulata in the water bodies of the northeastern USSR extends much farther west to Karelia (Hrabe, 1963; Chekanovskaya, 1965) and eastward as well, including Northern Alaska (Holmquist, 1974a). The recent first discovery of the species in the northern part of Western Siberia (Gydansky Peninsula) (Zaloznyi, 1976) permits us to assume that its range is not discontinuous in Siberia.

### 3. FAMILY ENCHYTRAEIDAE

#### Key to species

- 1 (2) Setae forked, with reduced distal tooth.....  
..... genus Propappus Michaelsen, 1 species P. arhynchotus Sok.  
2 (1) Setae simple-pointed.  
3 (4) Setae S-shaped, with noticeable nodule. Loops of postseptal part of  
nephridia lie almost freely in coelom, interstitial tissue not developed...  
..... genus Mesenchytraeus Eisen, 1 species Mesenchytraeus sp.  
4 (3) Setae S-shaped, with no nodule. Loops of postseptal part of nephridia  
connected by interstitial tissue..... genus Lumbricillus Orsted,  
1 species L. kamtschatkanus (Michaelsen)

Genus Propappus Michaelsen, 1905

Propappus arhynchotus Sokolskaja, 1972  
(fig. 15)

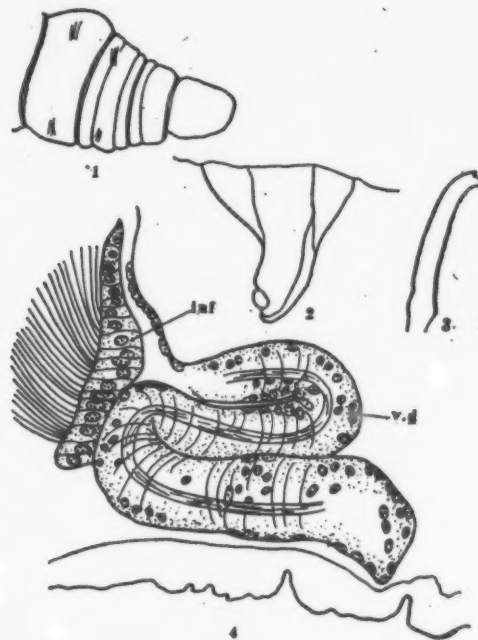


Fig. 15. Propappus arhynchotus Sokolskaja:

- 1 - anterior region of body, segments I-III (x150); 2 - penis (x600);  
3 - dorsal seta of segment II (x1350); 4 - male gonoduct (x600)  
(inf - sperm funnel, v.d. - vas deferens)

Sokol'skaya, 1972b: 83-85, fig. 5; 1973a: 64-66, fig. 8.

Description. Prostomium prolobar, large, turbinate without proboscis; ratio of base width to length 7:8. Cuticle of body integuments thick, with numerous minute tubercles randomly scattered over prostomium and anterior segment and more uniformly distributed in rings on succeeding segments. Intersegmental furrows and secondary annuli well-defined on segments I-VIII. Ventral and dorsal setae similar, forked, with distal tooth shorter and thinner than proximal one, with distal nodule. Anterior (preclitellar) segments each contain 3-6 setae in a bundle, succeeding segments usually 3 setae each. Dorsal setae 55-71  $\mu\text{m}$  long, ventral setae 59-76  $\mu\text{m}$  long. Setae increase in size posteriorly. Setal glands retort-shaped, consist of 8-10 cells.

(79)

Pharynx in segments II-III; narrow oesophagus expands into mid-intestine in segment XV; chloragogue cells present. Anterior nephridium in segment V.

Clitellum flat, cylindrical, on segments XII-XIV. One pair of male pores on segment XII in front of ventral bundles of setae. One pair of spermathecal pores on segment IV near anterior intersegmental furrow, approximately at midpoint between the line of ventral setae and the line of dorsal setae. One pair of testes in segment XI and one pair of ovaries in segment XII. One pair of large (diameter 105  $\mu\text{m}$ ) sperm funnels and wide vasa deferentia with thick glandular walls and a narrow canal. Length of vas deferens 310  $\mu\text{m}$ , diameter in proximal part 17  $\mu\text{m}$ , diameter in distal part 29  $\mu\text{m}$ ; width of canal of vas deferens about 6  $\mu\text{m}$  in proximal part and up to 7-8  $\mu\text{m}$  in distal part. Distal end of vas deferens forms expansion 34-38  $\mu\text{m}$  in diameter. Retractable conical penis present. Spermathecae without diverticula, not connected with oesophagus, with oval or sacciform ampulla occupying segment V and sometimes entering segment VI; spermathecal duct long with thick (15  $\mu\text{m}$ ) walls and a narrow (about 8  $\mu\text{m}$ ) canal.

Body dimensions: length 6-12 mm, maximum diameter 0.3-0.4 mm; S = 29-40.

Active worms.

Occurrence. Khairyuzovaya R. basin: streams; Kamchatka R. basin (Lake Ushkovskoye, springs on the shore of Lake Klyuchevskoye, Lake Azabach'ye); Zhupanov R. basin; Karymai (spring tributary of the Bol'shaya R.); Dal'nyaya R.

The species is common on stretches of water and sandbanks of the Karymai (depth up to 0.1 m) and has been frequently encountered in Lake Ushkovskoye on a sand substrate in shallow water (depth 0.10-0.45), sometimes on silted sand and in some cases on sand mixed with stones. In lakes Azabach'ye and Ushkovskoye, it has been found at temperatures of 3.4-5.4°C (in 1964-1965, at the end of March—beginning of April, in August, September, October and November). Mature specimens have been encountered at the end of August and in September.

Geographic distribution: Kamchatka.

Genus Mesenchytraeus Eisen, 1878

Mesenchytraeus sp.

Sokol'skaya, 1972b: 85-86 (Mesenchytraeus armatus?)

Accurate differentiation of the species is not possible due to the inadequate sexual maturity and preservation of the specimens available to us. (80)

Morphological data: Body length 8 mm, diameter in clitellar region 0.45 mm, number of segments 38. No secondary annulation of anterior segments. Dorsal bundles of segments V, VI and VII contain 1, (more commonly) 2 large and thick setae (88-101  $\mu$ m long, up to 8  $\mu$ m thick) with distal nodule (7:13, 8:13, 6:11). Dorsal bundles of segments II-IV each with 3-4 normal setae. Dorsal setae in segments behind clitellum usually arranged 3 in a bundle, 75  $\mu$ m long, 4  $\mu$ m thick, nodule distal (5:13). Ventral bundles of anterior (preclitellar) segments each with 7-10 setae about 65  $\mu$ m long and 4  $\mu$ m thick; ventral setae in segments behind clitellum somewhat shorter, 6-8 in a bundle.

Clitellum on segments XII-XIII. Male pores in place of ventral setae of segment XII.

Occurrence. Kamchatka R. basin (Kamchatka R., lakes Ushkovskoye and Azabach'ye); Lake Kambal'noye, Kikhchik R.

Genus Lumbricillus Orsted, 1844

Lumbricillus kamtschatkanus (Michaelson, 1929)

Michaelson, 1929: 317-319 (Pachydrilus).

Description. Fixed worms yellowish, light. Prostomium dome-shaped, length somewhat smaller than width of base. Cephalic pore very small, barely discernible. Setae slightly S-shaped, curved, 5-6 ventral setae and 3-4 dorsal setae per bundle on anterior segments; ventral and dorsal bundles in the middle of the body contain 2-3 setae each. Cephalic ganglion almost as long as its width, convex anteriorly, with wide and shallow notch posteriorly. Main septal glands (on dissepiments IV/V, V/VI and VI/VII) fused in pairs on dorsal side, encompassing the intestine in an arc; auxiliary septal glands in segments IV, V and VI. Oesophagus passes into mid-intestine gradually. Dorsal vessel begins in segment XV. Anteseptal part of nephridium very small and funnel-shaped; postseptal part elongated (twice as long as wide), efferent duct shorter than postseptale. Sperm funnel oblong (length 2-3 times greater than width). Testes and ovaries racemose. Vasa deferentia very thin and long, rolled up in a ball. Bulbar part of atrium large, almost spheroidal. Copulatory glands very small, almost the same in segments III, IV, V and XIV, even smaller in segments XIII and XV. Spermathecae with bulbiform ampullae, connect with oesophagus by means of short narrow ducts; spermathecal duct sharply delimited from ampulla, twice as long and about half as wide as ampulla, with narrow canal lined with large epithelial glandular cells; small multicellular glands at distal end of duct.

Body dimensions: length 5-6 mm, maximum diameter 0.45 mm, number of segments 40-45.

Occurrence. Lake Kurilskoye\*.

Encountered by Michaelsen at a depth of 2-3 m, mature specimens found on 22 September (1909).

Not found in collections examined by us.

Geographic distribution: Kamchatka.

Order Lumbricomorpha

1. FAMILY LUMBRICULIDAE

Key to species

- 1 (2) Setae forked, with distal tooth much shorter and thinner than proximal one (fig. 16)..... Lumbriculus variegatus (Müller)
- 2 (1) Setae with edentate distal end, pointed or blunt.
- 3 (4) Prostomium with proboscis..... Rhynchelmoides malevici, sp. n.
- 4 (3) No proboscis.
- 5 (10) One pair of testes and sperm funnels in segment VIII, one pair of ovaries in segment X. One pair of atria opens in pores on segment VIII. Atria long, occupy more than one segment, found in seminal vesicles....  
.... genus Styloscolex Michaelsen, subgenus Styloscolex s. str.
- 6 (7) Two pairs of spermathecae with pores in segments VII and XI.....  
..... S. (S.) tetrathecus Burow
- 7 (6) One pair of spermathecae with pores in segment VII or in segment XI.
- 8 (9) Spermathecal pores in segment XI. Wall of atrial ampulla with very thin muscular layer (3.4-4.0  $\mu$ m thick).....  
..... S. (S.) opisthothecus Sokolskaja
- 9 (8) Spermathecal pores in segment VII. Wall of atrial ampulla with well-developed muscular layer (9-15  $\mu$ m thick).... Styloscolex (S.) sp.
- 10 (5) Two pairs of testes and sperm funnels in segments IX and X, one pair of ovaries in segment XI. One pair of atria opens in ♂ pores in segment X. Atria with oviform ampulla found in the cavity of segment X.
- 11 (12) One pair of spermathecae in front of atrial segment (in IX).....  
..... Stylodrilus (B.) chukotensis Sokolskaja

- 2 (11) One pair of spermathecae behind atrial segment (in XI).....  
..... Trichodrilus itchaensis Sokolskaja

Genus Lumbriculus Grube, 1844

Lumbriculus variegatus (Müller, 1774)  
(fig. 16)

Michaelson, 1929: 326-328. Sokol'skaya, 1961: 64-65; 1972b: 86.

Description. Worms dark red with green and brown tones, grayish brown pigment in body wall. Prostomium elongated (length greater than width of base). Intersegmental furrows well-defined, especially in posterior region of body. Setae forked with reduced distal tooth and distal nodule. Blood vessels of segments II-VIII form plexus; from segment IX-X one pair of annular non-branching vessels and one pair of lateral blind appendages, sacciform in anterior part of body and branching in succeeding segments. Blind appendages and dorsal vessel covered with chloragogue tissue.

Reproductive system varies. One or two pairs of testes in segment VIII or VII and VIII. One pair of sperm funnels on dissepiment VIII/IX. Long and thin vasa deferentia fall into middle part of pyriform atrium. One pair of male pores on segment VIII behind ventral setae. Usually one pair of ovaries in segment IX, but may be up to 3 pairs (in segments IX-XI or X-XII). Spermathecae pyriform, without diverticula, usually 3 pairs (in segments X-XII), but may be many more.

Mature specimens encountered rarely. Reproduce mainly by architomy.

Dimensions: length 40-90 mm, diameter 1-1.5 mm, number of segments 140-220.

Swimmer (whip-like movement).

Occurrence. Kamchatka R. basin (Kamchatka, Bystraya and Raduga rivers); lakes Kenuzhen, Kursin\*, Glubokoye\*; Lake Nachikinskoye; Lake Kuril'skoye\*, Lake Bol'shoye, Tarkhovka R.\*; Monastyrskiy spring\*.

Michaelsen (1929) is quite certain that the species inhabits Lake Bol'shoye where the only mature specimen was found. He assigns the worms from the Monastyrskiy spring and the Tarkhovka R. to the species L. variegatus "with high probability", and only assumes that it may be present in lakes Kursin, Glubokoye and Kuril'skoye (only juvenile worms encountered). Only immature worms were found in the material examined by us.

The species has been encountered at depths from 0.15 to 1.7 m in overgrowths and detritus, on a silty (with detritus) and sandy substrate (sometimes mixed with pebbles), and once on stones in grass.

A mature worm was found on 16 June 1909 (Michaelsen, 1929).

Geographic distribution: Northern hemisphere, S Africa, Australia, New Zealand.



Fig. 16. Lumbriculus variegatus (Müller). Seta (after O.V. Chekanovskaya, 1962)

Genus Trichodrilus Claparède, 1862

Trichodrilus itchaensis Sokolskaja, 1973  
(fig. 17)

Sokol'skaya, 1972a: 10; (Trichodrilus sp.); Sokol'skaya, 1973b: 1714-1716, fig.

Description. Prostomium varies from short dome-shaped to long turbinate (ratio of length to width of base from 2:3 to 34-27). Secondary annulation of anterior segments begins from segment III or IV (more commonly IV), anterior ring 4-7 times narrower than setiferous posterior ring. Setae S-shaped, edentate, with distal nodule.

Clitellum on segments 1/n IX-XIII. Genital pores on line of ventral setae or slightly more ventrad: one pair of male pores behind ventral bundles of

segment X, one pair of female pores in intersegmental furrow XI/XII; one pair of spermathecal pores on segment XI behind ventral bundles, very close to them.

Pharynx in segments II-IV, chromophil cells in segments III-VI. Chloragogue tissue covers intestine from segment VI. Postseptale of anterior nephridium in segment VII.

Two pairs of testes in segments IX and X. One pair of ovaries in segment XI. Two pairs of sperm funnels on dissepiments IX/X and X/XI. Posterior pair of vasa deferentia forms loop in segment XI. One pair of atria in segment X, with oviform thick-walled ampulla and slightly curved atrial duct. Anterior and posterior vasa deferentia go into distal part of atrial ampulla and inside its wall at the boundary of the muscular layer and epithelium of the atrial cavity extends toward the proximal part, falling into the cavity in the middle third of the ampulla. Length of atrial ampulla 150-322  $\mu\text{m}$ , maximum diameter from 112 to 150  $\mu\text{m}$ , ratio of ampulla length to diameter varies (from 1.3 to 2.2). Absolute thickness of muscular layer of ampulla wall varies from 17-24 to 26-39  $\mu\text{m}$ , ratio of thickness of muscular layer to (maximum) diameter of ampulla from 0.18 to 0.26. Atrial duct well-defined, ends in penial tubercle. One pair of spermathecae in segment XI, with large oval ampulla and duct extending from middle of ampulla wall facing ventral side of body. Duct divided into main cylindrical and conical distal parts, latter constitutes 1/4-1/5 of total length of duct. Length of spermathecal duct 129-210  $\mu\text{m}$ , diameter of cylindrical part 47-67  $\mu\text{m}$ . Seminal vesicle unpaired: anterior one (extends from dissepiment VIII/IX in cavity of segment VIII) not always present; posterior one (from dissepiment X/XI) ends in segment XIX. Ovisac begins from dissepiment XI/XII.

Body dimensions: length 14-20 mm, diameter in clitellar region up to 1.0 mm, number of segments 51-71.

Occurrence. Icha R., Poterennaya channel. Koryak upland: stream near Tilichiki village; Tololayevka R., upper third.



Fig. 17. Trichodrilus itchaensis Sokolskaja:

1 - atrium (x300); 2 - porophore and male pore (x400); 3 - seta (x1800); 4 - spermatheca (x200) (at - atrial ampulla, pr - prostatic cells, spth. p - spermathecal pore, ♂ p - male pore)

The specimens from the Tololayevka R. and the stream of Tilichiki village are distinguished from the Kamchatka and Chukchi worms by small dimensions of the body (14-16 mm) and setae (about 100  $\mu$ m) and by a sharply tapering caudal end. Pharynx as a rule in segments II and III, chromophil cells in segments III-IV, concentration of these cells in segment III not high. Chloragogue tissue covers intestine from middle of segment VI. Thickness of muscular layer of atrial wall quite constant (21-30  $\mu$ m), its ratio to maximum diameter of atrial ampulla (m/d) varied from 0.20 to 0.26. Ratio of length of atrial ampulla to its diameter varied from 1.5 to 2.2.

The species has been encountered in shallow water (depth 0.15 m) at a current velocity of 60 cm/s and water temperature of 6°C (4 August 1972) in great abundance in both water bodies (30-77 specimens per sample).

Mature specimens have been noted at the beginning of August (4-7th), and more than one-half of the specimens (50-100%) were mature.

Geographic distribution: Kamchatka, Koryak upland, Chukchi Peninsula.

Genus Stylodrilus Claparède, 1862

Stylodrilus (Bythonomus) chukotensis Sokolskaja, 1975 (fig. 18)

Sokol'skaya, 1975: 116-119, fig.

Description. Prostomium conical or dome-shaped. Secondary annulation of anterior segments begins from segment IV, setiferous ring several times wider than anterior one. Setae S-shaped, edentate, with nodule in distal third. (86)

Clitellum on segments IX-1/n XIII. Genital pores on line of ventral setae: one pair of male pores on segment X behind ventral bundles closer to intersegmental furrow X/XI, one pair of female pores in intersegmental furrow XI/XII, one pair of spermathecal pores on segment IX behind ventral bundles of setae and slightly more ventrad the line of ventral setae.

Pharynx in segments II-III, chromophil cells in segments IV-VI. Chloragogue tissue covers intestine from segment VI. Postseptale of anterior nephridium in segment VII.

Two pairs of testes in segments IX and X, one pair of ovaries in segment XI, two pairs of sperm funnels on anterior surface of dissepiments IX/X and X/XI. Two pairs of vasa deferentia, posterior ones form loop in segment XI. (87)  
One pair of atria in segment X with oviform ampulla and a duct with muscular walls. Ratio of length of atrial ampulla to its maximum diameter varies from 1.2 to 2.1. Length of atrial ampulla 147-259  $\mu\text{m}$ , maximum diameter 88-198  $\mu\text{m}$ . Thickness of muscular layer of wall of atrial ampulla varies (from 8.6 to 30  $\mu\text{m}$ ), the same as m/d (from 0.06 to 0.15). Anterior and posterior vasa deferentia

enter from opposite sides into wall of atrial ampulla in its distal part and extend almost horizontally in the muscular layer toward each other, opening into the atrial cavity side by side at the boundary of the distal third of the ampulla. One pair of spermathecae in segment IX, with large ovoid ampulla and a long (209-237  $\mu\text{m}$ ) thick-walled duct 55-69  $\mu\text{m}$  wide extending from the middle of the ampulla wall.

Two pairs of seminal vesicles: anterior ones extend from dissepiment VIII/IX into cavity of segment VIII, posterior ones from dissepiment X/XI up to segment XV. Paired ovisacs begin from dissepiment XI/XII and enter segment XVII.

Body dimensions: length 17-34 mm, diameter in clitellar regions 0.8-1.0 mm, number of segments 73-96.

Occurrence. Koryak upland: stream in Tilichiki village; Tololayevka R., upper part.

The specimens from the Koryak rivers are distinguished by larger dimensions (length 25-34 mm, body diameter up to 1.0 mm) in comparison with those from the Chukchi Peninsula (length 17-25 mm, diameter 0.8-0.9 mm) with almost the same number of segments (73-87 and 88-96 respectively). Setae of Koryak worms also longer (151  $\mu\text{m}$ ). Size of atrium and width of vasa deferentia reach maximum values (length 259  $\mu\text{m}$ , maximum diameter of atrial ampulla 198  $\mu\text{m}$ , diameter of vasa deferentia 30  $\mu\text{m}$ ). Atrial wall with thick (30  $\mu\text{m}$ ) muscular layer. Ratio  $m/d=0.15$  greater than in holotype (0.1) and twice as high as in specimens from lake on the 95-96th kilometre stretch of the Egvekinot-Iul'tin highway (Chukchi Peninsula). Length of spermathecal ducts up to 237  $\mu\text{m}$ , diameter 69  $\mu\text{m}$ .

In Koryak rivers, species found on a silty-sandy substrate in abundance, 80-420 specimens per sample. Mature specimens encountered at the beginning of August (5-7th), comprising up to 28-30% of the population.

Geographic distribution: Chukchi Peninsula, Koryak upland.

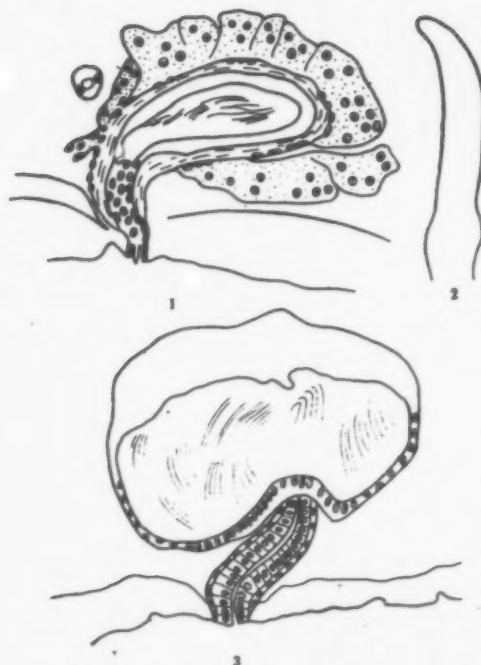


Fig. 18. Stylodrilus (Bythonomus) chukotensis Sokolskaja:  
1 - atrium and male pore (x300); 2 - seta (x1800); 3 - spermatheca (x200)

Genus Rhynchelmoides Hrabe, 1936

Rhynchelmoides malevici Sokolskaja, sp. n. (fig. 19)

Diagnosis. Prostomium with proboscis. Anterior segments biannulate beginning with segment II. Setae S-shaped, with edentate distal end, length of ventral setae on segments VIII-XIV 172  $\mu$ m. Clitellum on segments IX-XIII. Genital pores on line of ventral setae: one pair of male pores on segment X behind ventral bundles, one pair of female pores in intersegmental furrow XI/XII; one pair of spermathecal pores on segment VIII behind ventral bundles of setae not far from intersegmental furrow VIII/IX.

Pharynx in segments II-V, chromophil cells in segments IV, V and VI. Chloragogue tissue covers intestine from segment VI. Postseptale of anterior nephridium in segment VIII.

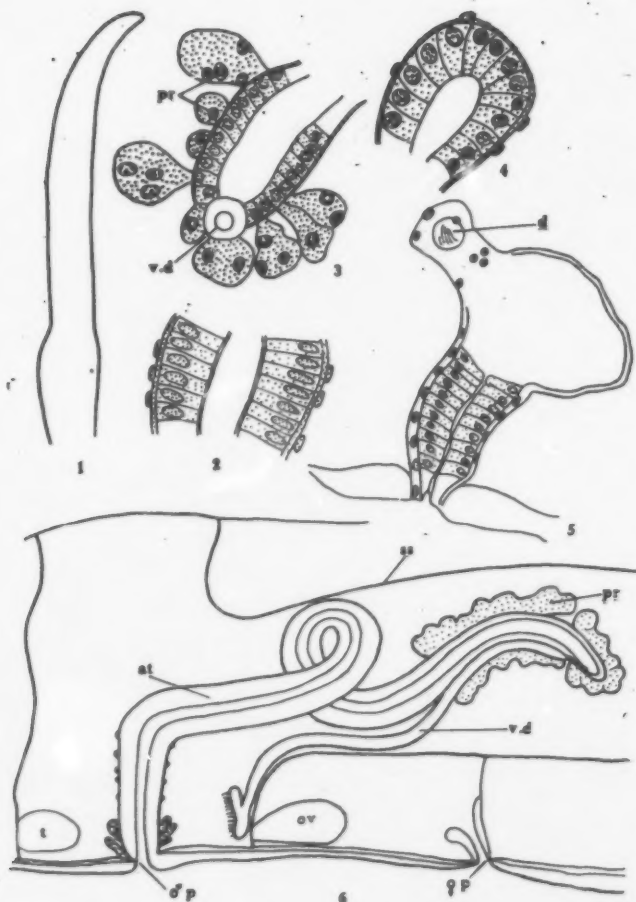


Fig. 19. *Rhynchelmoides malevici*, sp. n.

1 - ventral seta of segment VIII (x1800); 2 - section of wall of distal part of atrium; 3 - section of wall of proximal part of atrium; 4 - section of wall of middle part of atrium (x600); 5 - spermatheca (x300); 6 - general view of male gonoduct (reconstructed from a series of sections) (at - atrium, t - testis, ov - ovary, pr - prostatic cells, v.d - vas deferens, d - spermathecal diverticulum joined with oesophagus, ss - wall of seminal vesicle)

Thickness of layers of musclocutaneous sac in segment XIV: epidermis 15  $\mu$ m, circular layer of muscles 2  $\mu$ m, longitudinal layer of muscles 26-34  $\mu$ m. Longitudinal musculature forms 8 bands, the edges of which are not turned into the body cavity.

One pair of testes and sperm funnels in segment X, one pair of ovaries and egg funnels in segment XI. One pair of wide vasa deferentia. Vas deferens

goes into wall of atrium 86  $\mu$ m from its proximal end and falls into atrial cavity subapically. One pair of tubular contorted atria, tapering proximally, are found in seminal vesicles of segments XI and XII. Prostatic cells cover only proximal third of atrium (narrower part with thinner walls). No penis. One pair of spermathecae in segment VIII, with wide oval ampulla connected with oesophagus by posterior diverticulum, with long and wide duct with thick walls and a narrow canal.

Distal ends of spermathecal duct and atrium surrounded by glandular cells.

One pair of posterior seminal vesicles extends from dissepiment X/XI and goes into segment XVII. One pair of rudimentary seminal vesicles found near dissepiment IX/X. One pair of ovisacs extends from dissepiment XI/XII and goes into segment XVIII.

Body dimensions: length 29 mm, diameter 0.9 mm, number of segments 76.

Description. Prostomium with proboscis with external annulation; length of proboscis 578  $\mu$ m, width of base 183  $\mu$ m. Anterior segments, beginning with II, biannulate, with wide anterior setiferous ring and narrow posterior ring. Setae S-shaped, with edentate distal end. Length of ventral setae of segment II 177  $\mu$ m, thickness (under nodule) 6  $\mu$ m; length of ventral setae of segments VIII-XIV 172  $\mu$ m, thickness 8  $\mu$ m, nodule distal (10:30, 11:30, 11:29).

(90)

Clitellum cylindrical, low, on segments IX-XIII. Genital pores on line of ventral setae; one pair of male pores on segment X behind ventral bundles of setae, one pair of female pores in intersegmental furrow XI/XII. Spermathecal pores (one pair) on segment VIII behind ventral bundles not far from intersegmental furrow VIII/IX.

Pharynx in segments II-V, chromophil cells in segment IV, V and VI.

Postseptale of anterior nephridium in segment VIII.

Thickness of layers of musclocutaneous sac in segment XIV and behind segment XX: epidermis 15  $\mu\text{m}$ , circular layer of muscles 2  $\mu\text{m}$ , layer of longitudinal muscles 26-34  $\mu\text{m}$ . Longitudinal musculature forms 8 bands with margins not turned into body cavity.

Inadequate fixation and limited material does not permit us to describe the circulatory system.

One pair of testes in segment X. One pair of ovaries and egg funnels in segment XI. One pair of sperm funnels on anterior surface of dissepiment X/XI in its ventral part. One pair of wide (26  $\mu\text{m}$ ) vasa deferentia with thick (8.6  $\mu\text{m}$ ) walls and with ciliated canal. Vas deferens extends from sperm funnel dorsally along dissepiment X/XI, enters seminal vesicle and runs in caudal direction parallel to atrium. In proximal part of atrium, vas deferens enters layer of prostatic cells covering surface of atrium and passes through to its proximal end, tightly pressing against atrial wall. 86  $\mu\text{m}$  from proximal end, vas deferens enters atrial wall and, after passing through it briefly, falls into atrial cavity subapically. Vas deferens narrow (13-17  $\mu\text{m}$ ) inside atrial wall, with thin wall (2-4  $\mu\text{m}$ ). One pair of contorted tubular atria, narrowed proximally, largely in seminal vesicles of segments XI-XII. Atrial wall consists of epithelial layer which lines the atrial cavity, and a very thin muscular layer. Proximal third of atrium narrow (34-47  $\mu\text{m}$ ), with thin walls (8.6  $\mu\text{m}$ ) in which muscular layer is barely discernible with x900 magnification, covered with prostatic cells. Gradually widening, it passes into middle part without prostatic lining, diameter about 69  $\mu\text{m}$ . Middle part of atrium thick-walled (22  $\mu\text{m}$ ), with high glandular epithelium and thin muscular layer. In distal part of atrium (from outlet from seminal vesicle to male pore) which passes in cavity of segment X in ventral direction, epithelium of wall loses its glandular character and muscular layer becomes thicker. Diameter of distal

part 69  $\mu\text{m}$ , thickness of wall 26  $\mu\text{m}$ . Atrium opens in male pore, no penis. One pair of fungiform spermathecae in segment VIII, with small, wide, oval ampulla (151 x 109  $\mu\text{m}$ ) connected to oesophagus by posterior diverticulum. Spermathecal duct long (138  $\mu\text{m}$ ), wide (69  $\mu\text{m}$ ), with thick walls (30  $\mu\text{m}$ ) and narrow canal.

Distal ends of spermathecal duct and atrium surrounded by accumulation of glandular cells.

One pair of posterior seminal vesicles extends from dissepiment X/XI and goes into segment XVII; one pair of rudimentary seminal vesicles extends from dissepiment IX/X. One pair of ovisacs begins from dissepiment XI/XII and enters segment XVIII.

Description of reproductive system based on holotype with full seminal vesicles and ovisacs, and spermathecal ampullae containing some spermatozoa.

Body dimensions: length 29 mm, diameter in clitellar region 0.9 mm, number of segments 76.

Occurrence. Tololayevka R., upper third, depth 0.15 m, temperature 6°C, current velocity 60 cm/s (Ye.A. Nikolayeva, 4 August 1972).

Species named after I.I. Malevich.

Holotype stored at Zoological Museum of Moscow State University, No. 0-1256.

Geographic distribution: Koryak territory.

S.A. Hrabe (1936) established the North American species Rhynchelmis elrodi Smith et Dickey, 1918 as the genus Rhynchelmoides Hrabe on the basis of the structure of the longitudinal muscles of the body wall. The longitudinal muscular layer in the given species is divided into longitudinal bands as in the species of Rhynchelmis Hoffmeister, but their margins do not form the recurvatures into the coelom which are characteristic of Rhynchelmis, separating in this case from the layer of circular musculature. S.A. Hrabe (1962) later

proved the independence of the genus Rhynchelmoides. D. Cook (1971) does not acknowledge the genus Rhynchelmoides and includes Rh. elrodi in the genus Rhynchelmis. We believe that the indicated architectonic characteristics of the musculocutaneous sac should be taken into consideration when establishing a genus. There is no doubt that S.A. Hrabe's genus is similar to Rhynchelmis. In addition to Rh. elrodi, the similar Rh. glandula Altman, 1936 and the described Rh. malevici, the genus Rhynchelmoides should include, on the basis of the structure of the longitudinal muscles of the body wall, the Northern Alaskan species described by Holmquist (1976) Rh. alaskana Holmquist, Rh. brooksi Holmquist and Rhynchelmis sp. Perhaps it should also include Rh. orientalis Yamaguchi from Hokkaido, which is described as having longitudinal muscles divided into 8 bands, but without any indication of whether their margins are turned into the body cavity (Yamaguchi, 1936). No such data is available for Rh. tetrathecus Michaelsen, 1920 or Rh. olchonensis Burow et Koshow, 1932 either.

(93)

In a number of characteristics (table 1) and the structure of the reproductive system, specifically the male gonoduct, Rh. malevici is very similar to Rh. brooksi (form and length of the atrium, histological differentiation of its parts, limited nature of the prostatic lining of the atrium, connection of the vas deferens with the atrium, absence of a penis). The spermathecal ampulla in both species is connected to the oesophagus by the posterior diverticulum. The Alaskan and Koryak species differ sharply in the form of the setae (forked in Rh. brooksi), the location of the male pores and spermathecal apertures (slightly more mediad the line of ventral setae in Rh. brooksi), and in the location of the postseptale of the anterior pair of nephridia (in segment XIII in Rh. brooksi).

(93)

Table 1. Comparison of the species Rh. brooksi (Holmquist) and Rh. malevici, sp.n.

| Characters                                     | <u>Rh. brooksi</u>                                          | <u>Rh. malevici</u>                                                           |
|------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------|
| Body dimensions, mm:                           |                                                             |                                                                               |
| length                                         | 28                                                          | 29                                                                            |
| diameter                                       | 0.7-0.8                                                     | 0.9                                                                           |
| Number of segments                             | 55-75                                                       | 76                                                                            |
| Secondary annulation of anterior segments      | more or less noticeable                                     | distinct, from segment II, anterior setiferous ring wider than posterior ring |
| Proboscis                                      | with surface segmentation                                   | with surface segmentation                                                     |
| Setae                                          | forked                                                      | edentate                                                                      |
| Location of clitellum                          | IX-XIII                                                     | IX-XIII                                                                       |
| Male pores                                     | on X, behind and slightly mediad ventral setae              | on X, on line of ventral setae, closer to posterior intersegmental furrow     |
| Female pores                                   | in intersegmental furrow XI/XII                             | in intersegmental furrow XI/XII                                               |
| Spermathecal apertures                         | on VIII, behind ventral bundles, slightly mediad the latter | on VIII, on line of ventral setae, behind bundles                             |
| Circular layer of body wall muscles            | inconspicuous                                               | thin (2 $\mu$ m)                                                              |
| Location of chromophil cells                   | (III), IV, V (VI)                                           | IV, V, VI                                                                     |
| Beginning of chloragogue tissue of intestine   | VI (dorsal side), VII                                       | VI                                                                            |
| Location of postseptale of anterior nephridium | XIII                                                        | VIII                                                                          |
| Testes                                         | One pair in segment X                                       | One pair in segment X                                                         |
| Sperm funnels                                  | One pair in segment X                                       | One pair in segment X                                                         |
| Atria (tubular)                                | 1 pair in X-XII (XIII)                                      | 1 pair in X-XII                                                               |
| Point of entry of vas deferens into atrium     | subapically                                                 | subapically                                                                   |
| Prostatic lining of atrium                     | in proximal 1/4-1/3 of atrium                               | in proximal 1/3 of atrium                                                     |
| Penis                                          | None                                                        | None                                                                          |
| Ovaries and egg funnels                        | 1 pair in segment XI                                        | 1 pair in segment XI                                                          |
| Spermathecae                                   | 1 pair in segment VIII                                      | 1 pair in segment VIII                                                        |

(table 1 continued)

| Characters        | <u>Rh. brooksi</u>                                 | <u>Rh. malevici</u>                         |
|-------------------|----------------------------------------------------|---------------------------------------------|
| Seminal vesicles: |                                                    |                                             |
| anterior          | from dissepiment IX/X,<br>go into segment IX       | rudimentary, from dissepiment IX/X          |
| posterior         | from dissepiment X/XI<br>up to segments XVII-XVIII | from dissepiment X/XI up to<br>segment XVII |

Genus Styloscolex Michaelsen, 1901

Subgenus Styloscolex s. str.

Styloscolex (Styloscolex) tetrathecus Burow, 1931 (fig. 20)

Sokol'skaya, 1978: 181-185, 188-189, fig. 1.

Description. Bright orange in colour. Body slightly transparent. Prostomium large, elongated, length greater than width of base. Intersegmental furrows especially well-defined on anterior segments (up to VI). Beginning with IV, segments bear secondary annulation with anterior ring 4 times narrower than setiferous posterior one. Setae thin with edentate distal end. Length of setae of segments VIII-XII 129-150  $\mu\text{m}$ , thickness 5-7.5  $\mu\text{m}$ . Thickness of layers of musclocutaneous sac in segments XVI-XVIII: cuticle 1.0-2.2  $\mu\text{m}$ , tectorial epithelium 4-6.6  $\mu\text{m}$ , circular muscles 3.5-4.4, longitudinal muscles 17.6-50  $\mu\text{m}$ . Pharynx in segments II-IV, pharyngeal glands (chromophil cells) in segments III, IV and V. Chloragogue tissue covers intestine from posterior half of segment V or from beginning of segment VI. Postseptale of anterior nephridium in segment VII.

Clitellum convex, sharply delimited, on segments 1/n VII-XI (1/n XII).

Genital pores on line of ventral setae: one pair of male pores in segment VIII behind ventral bundles, one pair of female pores in intersegmental furrow X/XI; 2 pairs of spermathecal pores in segments VII and XI behind ventral bundles of setae.

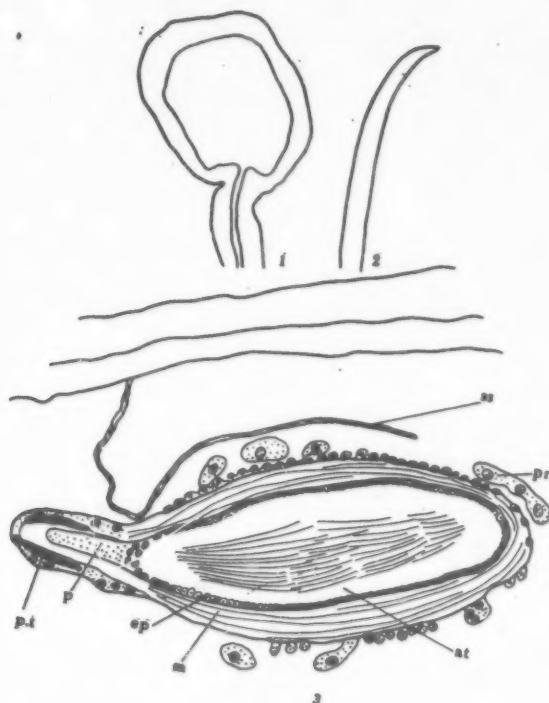


Fig. 20. Styloscolex (Styloscolex) tetrathecus Burow:

1 - amulla and part of spermathecal duct (x300); 2 - dorsal seta of segment VIII (x1350); 3 - atrium and penis (x300) (at - atrial ampulla, ep - epithelium lining atrial cavity, m - muscular layer of atrial wall, pr - prostatic cells, p - penis, p.t - penial tubule, ss - wall of seminal vesicle)

One pair of testes and sperm funnels in segment VIII. One pair of ovaries and egg funnels in segment X. One pair of atria, elongated, tapering distally and proximally, occupies segments VIII-X, going into seminal vesicles; length of atrial ampullae about 250  $\mu$ m, maximum diameter 75-141  $\mu$ m. Walls of atrial ampullae thick, with well-developed muscular layer (17.6  $\mu$ m thick); ratio of thickness of muscular layer to diameter of atrium (m/d) = 0.12. Atrium passes into penis enclosed in cuticular penial tubule and found in large penial bursa. Two pairs of spermathecae: 1st pair with almost spheroid ampullae (183 x 172  $\mu$ m) (in segment VII), 2nd (posterior) pair with large sacciform ampullae (in segments XII-XIV) and long thick-walled ducts perforating dissepiment XI/XII. Paired seminal vesicles extend from dissepiment VIII/IX and go into segment XV. Ovisacs reach segment XXII.

Body dimensions: length 14-25 mm, diameter in clitellar region 0.70-0.72 mm, number of segments 56-70.

Occurrence. Koryak upland: Lake Potatgytkhyn.

The species has been encountered on silty sand with plant remains at a depth of 10.1 m. The mature specimens of S. tetrathecus examined by us differed somewhat from the Baikal specimens described by V.S. Burov (1931) and V.V. Izosimov (1962), which we believe are of no taxonomic significance (Sokol'skaya, 1978); these differences include smaller dimensions of the body and setae, the number of segments, a thinner layer of longitudinal musculature in the body wall, a shorter and wider atrium, etc. (96)

Geographic distribution: Lake Baikal, NE China, Koryak upland (Lake Potatgytkhyn).

Styloscolex (Styloscolex) opisthothecus Sokolskaja, 1969 (fig. 21)  
Sokol'skaya, 1969: 342-344, fig. 1-2; 1972b: 86; 1978: 185-189.

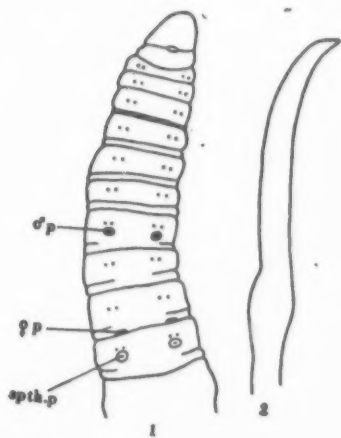


Fig. 21. Styloscolex (Styloscolex) opisthothecus Sokolskaja:

1 - anterior region of body from ventral side (x30); 2 - dorsal seta of segment VI (x1350)  
o p - male pore, o p - female pore, spth.p - spermathecal pore)

Description. Prostomium large, rounded: width of base greater or smaller than length. Anterior segments, beginning with III or IV, biannulate: anterior ring 4 times narrower than posterior one bearing bundles of setae. Setae edentate with distal nodule, on segment XII, 134  $\mu$ m long and 6  $\mu$ m thick.

Thickness of layers of musclocutaneous sac in segments XVI-XX: epidermis 7-8  $\mu\text{m}$ , circular muscles 2.5  $\mu\text{m}$ , longitudinal muscles 20-25  $\mu\text{m}$ . Pharynx in segments II-III, chloragogue tissue covers intestine from segment VI. Post-septale of anterior nephridium in segment VII.

Clitellum convex, from 1/2 VII to XI (1/n XII). Genital pores on line of ventral setae: one pair of male pores on segment VIII behind ventral bundles, one pair of female pores in intersegmental furrow X/XI; one pair of spermathecal pores on segment XI behind ventral bundles of setae. One pair of testes and sperm funnels in segment VIII, one pair of ovaries and egg funnels in segment X. One pair of elongated atria, greater part of atria inside of seminal vesicles in segment IX, distal part of atria in segment VIII. Length of atrial ampullae up to 400  $\mu\text{m}$ , maximum diameter 88  $\mu\text{m}$ . Atrial walls thin, with very thin muscular layer (3.4-4.0  $\mu\text{m}$ ); ratio of thickness of muscular layer to diameter of atrium (m/d) 0.04. Vasa deferentia enter atrial wall in its distal part. Atria narrow distally and pass into long conical retractile penises enclosed in penial sheaths with muscular walls. Length of penis about 120  $\mu\text{m}$ , diameter of base 19  $\mu\text{m}$ . Cuticular penial tubule present. One pair of spermathecae with sacciform ampullae in segments XII-XIII and thick-walled atrial ducts perforating dissepiment XI/XII and opening in spermathecal pores in segment XI. Unpaired anterior seminal vesicle begins from dissepiment VII/VIII and goes into cavity of segment VII; paired posterior seminal vesicles begin from dissepiment VIII/IX and extend posteriorly to segment XXII. Paired ovisacs begin from dissepiment X/XI and enter segment XXIII. (97)

Body dimensions: length 25-40 mm, diameter 0.75-1.0 mm, number of segments 50-78.

Occurrence. Khairyuzovaya R. basin; Icha R. (Poterennaya channel); Kamchatka R. basin (Kamchatka R., Prigorodnyi spring, lakes Azabach'ye, Kenuzhen, Soldatskoye; springs); Lake Nachikinskoye; hot bath springs in upper part

of Bystraya R.; Plotnikov R.; Dal'nyaya R.; Karymaiskiy spring; Utka R. (Domashniy spring); Kuyev spring in Kikhchik R. basin.

In the majority of cases, this species was encountered at the sources of spring water. The depth at which S. opisthothecus was found varied from 0.3-0.5 (in springs) to 31 m (Lake Azabach'ye), and the substrates consisted of sand with pebbles (in springs) or silt with sand and pumice (in lakes).

Mature specimens were noted in February, March, April, May, June, July and August (during different years).

This is a common oligochaete species in Kamchatka.

Ch. Holmquist (1974b) came across this species in two lakes in Northern Alaska (north of 68° N); she notes certain differences between the specimens encountered by her in Alaska and the Kamchatka specimens, but believes they are due to different stages of maturity of the worms.

Geographic distribution: Kamchatka, Northern Alaska.

Styloscolex (Styloscolex) sp. (fig. 22)

Sokol'skaya, 1978: 187, fig. 2.

Description. Prostomium with rounded apex. Beginning with III, anterior segments bear secondary annulation: anterior setiferous ring much wider than posterior one (2.4-3.2 times wider). Setae with edentate distal end and distal nodule (11:24). Length of setae of segments VI-IX about 150 μm, thickness 6.6 μm. Clitellum occupies segments 1/n VII-XI. Genital pores on line of ventral setae: one pair of male pores behind ventral bundles of segment VIII, one pair of female pores in intersegmental furrow X/XI; one pair of spermathecal pores in segment VII behind and slightly ventrad ventral bundles of setae. (98)

Pharynx in segments II-IV, pharyngeal glands (chromophil cells) in segments IV-V. Chloragogue tissue covers intestine from segment VI. (99)

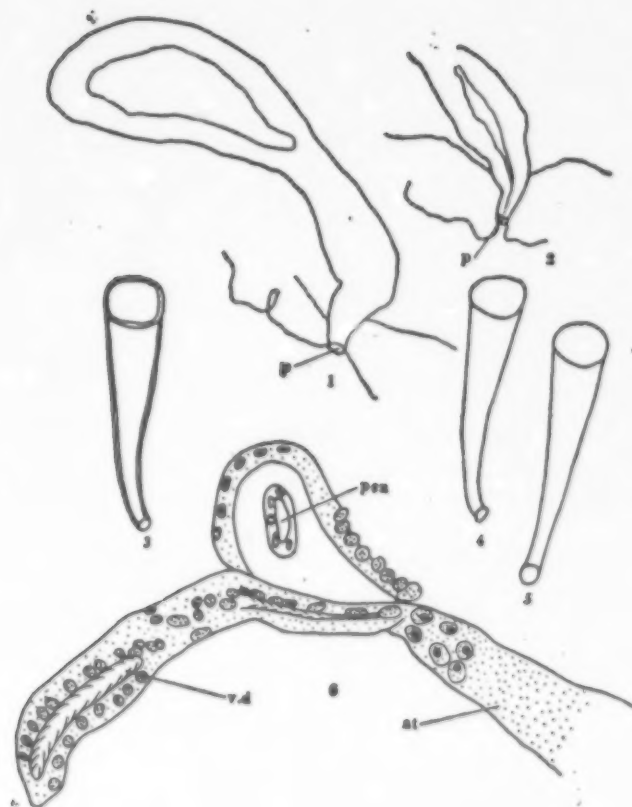


Fig. 22. Styloscolex (Styloscolex) sp.:

1 - spermatheca; 2 - distal part of spermathecal duct (x300); 3, 4, 5 - penial tubule from different angles, 3 - optical section (x400); 6 - point of entry of vas deferens into atrium (x600) (at - atrial ampulla, v.d - vas deferens, pen - penis, p - spermathecal pore)

One pair of testes and sperm funnels in segment VIII and one pair of ovaries and egg funnels in segment X. Thick-walled vasa deferentia (up to 7  $\mu$ m) enter distal part of atrium. One pair of atria with long (up to 709  $\mu$ m) sacciform, distally tapering ampullae reaches end of segment X. Ampullae of paired atria arranged asymmetrically: one in posterior seminal vesicle and the other in anterior one. Walls of atrial ampullae with well-developed muscular layer 9-15  $\mu$ m thick. Distal narrowed parts of atria pass into thin and long (up to 152  $\mu$ m) penises with diameter of base 29  $\mu$ m. Distally curved penial tubule present. One pair of spermathecae with oviform ampulla and long

thick-walled duct. Spermathecal duct perforates dissepiment VI/VII and opens in a pore in segment VII (ampulla in segment VI). Seminal vesicle unpaired: anterior one extending from dissepiment VII/VIII goes into segment VI, posterior vesicle begins from dissepiment VIII/IX and ends in segment XV.

One pair of anterior spermathecae (spermathecal pores in segment VII) distinguishes this species from the common Kamchatka species S. opisthothecus (pair of posterior spermathecae with pores in segment XI) and S. tetrathecus found in Lake Potatgytkhyn, which has a pair of anterior and a pair of posterior spermathecae.

Occurrence. Utka R., Domashniy spring.

Species noted at a depth of 0.25 m at a current velocity of 60 cm/s and water temperature of 10.5°C (16 August 1972). Mature specimens noted on 12 June (1959).

Among the specimens studied, we came across immature worms of the family Lumbriculidae with forked setae, which apparently did not belong to the species Lumbriculus variegatus.

Occurrence. Khairyuzovaya R. basin (Bystraya, Tikhaya and Insuch rivers); Penzhina R.

Worms found in samples taken at small depths (0.2-0.4 m) by the suspension method at a current velocity of 70 cm/s and water temperature of 10-14.2°C (4 September and 18 August 1972).

## 2. FAMILY KURENKOVIDAE SOKOLSKAJA, FAM. N.

Type genus: Kurenkovia Sokolskaja, 1969

Diagnosis. Segments bear 4 bundles of setae, 2 ventral and 2 lateral; each bundle contains 2 setae. Digestive tract without stomach. Two pairs of testes and sperm funnels in segments VIII and IX. Distal parts of anterior and posterior pairs of vasa deferentia go into body wall and pass inside it (100)

along the boundary of the epithelium and muscular layer towards each other, opening in 2 pairs of male pores on the same segment (IX). Unpaired and paired copulatory glands present (in region of male pores). One pair of ovaries and egg funnels in segment X, one pair of female pores in intersegmental furrow X/XI. One pair of simple (without diverticula) spermathecae with pores in segment VII. Rudimentary atria in segment VIII. Seminal vesicles and ovisacs present.

When describing the genus Kurenkovia, we noted that it stood apart from the other Lumbriculidae and perhaps could be established as a separate subfamily (Sokol'skaya, 1969). We currently regard this genus as a member of the monotypic family, though we do not have any new material at our disposal.

#### Characteristic features of the new family

1. The functioning male gonoducts do not have any atria, and the vasa deferentia open directly as male pores.
2. Two pairs of male pores open on the same segment (IX) in the region of paired copulatory glands.
3. The distal parts of the vasa deferentia take root in the body wall of the worm, and inside it cover their final distance at the boundary of the epithelium and muscular layer.
4. The atria with a diffuse prostate are like rudimentary organs which are not connected with the functioning system of male gonoducts.

The described family has a reproductive system which combines features characteristic of several families of oligochaetes. Undifferentiated (no atria) functioning gonoducts (1) are typical of the family Haplotaxidae. The relative position of the testes and male pores in Kurenkovia differs from that of Haplotaxidae where the male pores always open in the segment following the one with the testis and corresponding to the sperm funnel. It repeats the

pattern typical of many of the genera of Lumbriculidae (Stylodrilus Claparède, Trichodrilus Claparède, etc.), but with the significant difference that the absence in the Kurenkoidae of an atrium which in the Lumbriculidae receives the anterior and posterior vasa deferentia results in an original situation, i.e. both pairs of vasa deferentia open on the same segment (IX) (2). The paired copulatory glands in the region of the male pores perform the function of the atria to some extent. The deep insertion of the vasa deferentia in the body wall (3) is known in the family Glossoscolecidae where they pass inside the muscular layer, i.e. in phylogenetically remote groups.

Genus Kurenkovia Sokolskaja, 1969

Kurenkovia magna Sokolskaja, 1969 (fig. 23)

Sokol'skaya, 1969: 345-349, fig. 3-4.

Description. Prostomium short (ratio of length to width of base 3:4), rounded, without appendages. Anterior segments biannulate, wide ring setiferous; new secondary annuli appear from segment VI. Setae slightly S-shaped, with edentate distal end. Length of setae about 260  $\mu\text{m}$  (in posterior region of body).

Clitellum on segments IX-XI. Spherical glandular rosettes (copulatory glands) located on ventral side of genital segments, unpaired in anterior part of segments VII, VIII and X, and paired behind ventral bundles of setae in segment IX. Two pairs of male pores on segment IX in region of copulatory glands; one pair of female pores in intersegmental furrow X/XI; one pair of spermathecal pores in segment VII near anterior intersegmental furrow laterad line of ventral setae.

Pharynx in segments II-III, chromophil cells in the same segments. Chloragogue tissue covers intestine from segment VI. Postseptale of anterior nephridium in segment XIII.

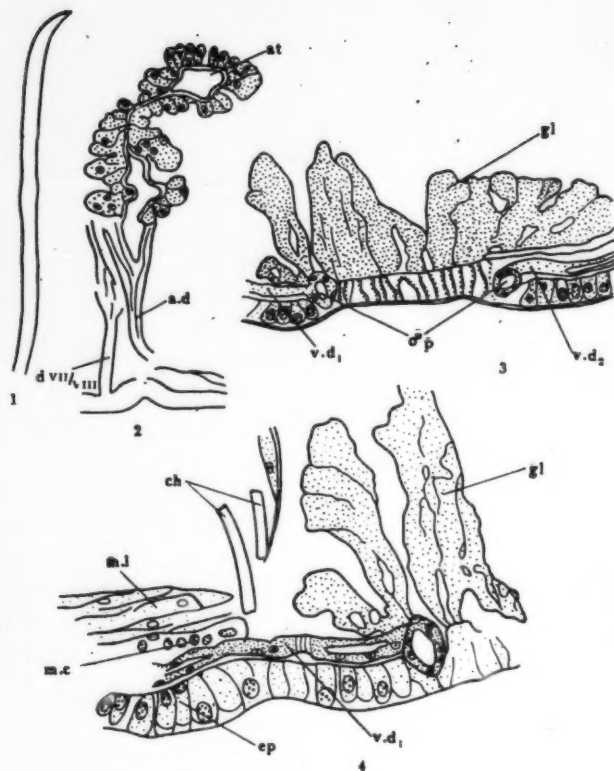


Fig. 23. *Kurenkovia magna* Sokolskaja:

1 - dorsal seta of segment XII (x600); 2 - rudimentary atrium; 3 - sagittal section in region of copulatory glands of segment IX (x200); 4 - the same with high magnification (x400) (at - atrial ampulla, a.d - atrial duct, d VII/VIII - dissepiment separating segments VII and VIII (gl - glands; v.d<sub>1</sub> - anterior vas deferens, v.d<sub>2</sub> - posterior vas deferens, ♂ p - male pores, ch - setae, m.l - longitudinal muscles of body wall, m.c - circular muscles of body wall, ep - epithelium)

Thickness of layers of musclocutaneous sac in anterior segments (IV): epidermis 12.6  $\mu$ m, circular layer of musculature - 6.3  $\mu$ m, longitudinal layer 84  $\mu$ m.

Two pairs of testes in segments VIII and IX, one pair of ovaries in segment X. Two pairs of functioning sperm funnels (in segments VIII and IX) and two pairs of vas deferentia extending from them. Vasa deferentia of posterior pair form loop in segment X. Distal ends of anterior and posterior pairs of vas deferentia go into ventral wall of body in segments IX and X

and extend between epithelium and musculature toward each other, opening on segment IX in region of copulatory glands. One pair of rudimentary atria in segment VIII, not connected with functioning vasa deferentia.

One pair of egg funnels in segment X.

One pair of spermathecae in segment VII, with large sacciform ampulla and thick-walled duct narrowing distally.

Seminal vesicles begin from dissepiment IX/X and enter segment XII, ovisacs from dissepiment X/XI extend to segment XIII.

Body dimensions: length 27-32 mm, diameter in clitellar region up to 2 mm, number of segments 54.

Occurrence. Karymai (spring tributary of Bol'shaya R.).

Mature specimens noted in February, May and October (during different years).

Species belongs to the monotypic Kamchatka genus.

Geographic distribution: Kamchatka.

### 3. FAMILY HAPLOTAXIDAE

Genus Haplotaxis Hoffmeister, 1843

Haplotaxis gordioides (Hartmann, 1821)?  
(fig. 24)

Michaelsen, 1929: 328-329 (Phreoryctes); Chekanovskaya, 1962: 322-323, fig. 203 (Haplotaxis); Sokol'skaya, 1961: 65; 1972b: 87.

Description. From pinkish to dark red in colour. Long and thin worms. Prostomium elongated, often separated by circular furrow. First segment very short. Segments V-XVIII biannulate, with narrow anterior ring. Setae edentate, solitary, 4 on each segment, or 2 on each segment as dorsal setae may be lacking. Ventral setae noticeably larger than dorsal ones. Ventral setae on segments XII-XIV with setal glands. No septal glands. Each segment with one pair of annular vessels. Clitellum occupies segments X-XIII. Two pairs of testes and sperm funnels in segments X and XI. Vasa deferentia not long, open in male

pores in front of ventral bundles of setae in segments XI and XII. Copulatory glands in segments XI-XIV. Two pairs of ovaries and egg funnels in segments XII and XIII; two pairs of female pores in intersegmental furrows XII/XIII and XIII/XIV. Three pairs of spermathecae in segments VII-IX. Seminal vesicles unpaired: one begins from dissepiment X/XI and reaches segment XII, the other extends from dissepiment XI/XII to segment XVIII. Unpaired ovisac extends to segment XIX.

Body dimensions: length 180-400 mm, diameter 0.3-2.0 mm, number of segments 200-480.

Occurrence. Khairuzovaya R. basin, streams; Kamchatka R. basin (lakes Ushkovskoye, Azabach'ye and Glubokoye\*, Ponomarskaya R.); Karymaiskiy spring, Plotnikov R.; Utko R. and its springs Domashniy and Lisiy; Nikolka R.; Avacha R.; Kirpichnaya R., Dal'nyaya R., Bystraya R.; Gavaikha R.; Krutaya R.; Lake Kuril'skoye\*.

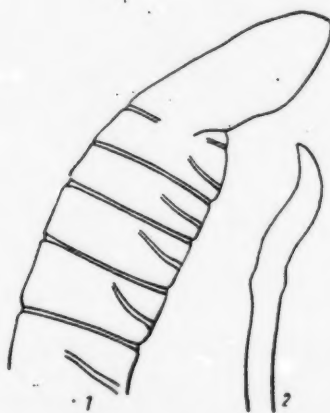


Fig.24 . Haplotaxis gordioides (Hartmann):

1 - anterior end of body (view from the side) (x100); 2 - ventral seta of anterior region of body (x400)

As a rule, the species was encountered at small depths (0.2-0.4 m) and on a stony bottom (stones, pebbles) or on sand (frequently volcanic, sometimes with gravel). In two cases it was encountered at a significant depth (9 m in Lake Azabach'ye, 60 m in Lake Kuril'skoye, in the first case on a silty substrate).

H. gordioides is regarded as a questionable species by Michaelsen (1929) and ourselves, as it is represented by immature specimens alone.

Geographic distribution: Holarctic Region.

#### 4. FAMILY LUMBRICIDAE<sup>1</sup>

Amphibiotic species of earthworms have been found in the coastal areas of some bodies of water.

##### Eisenia nordenskioldi (Eisen, 1879)

Michaelsen, 1929: 329; Sokol'skaya, 1972b: 87.

Occurrence. Spring on the bank of the Makar'yevskaya R. (Litke strait); Lake Klyuchevskoye\*.

Geographic distribution: Siberia, Eastern Europe.

##### Dendrodrilus rubidus (Savigny, 1826) var. tenuis (Eisen, 1874)

Michaelsen, 1929: 329 (Bimastus tenuis); Sokol'skaya, 1972a:7 (Dendrobaena rubida (Sav.) var. tenuis).

Occurrence. Nachikinskiy spring\*; Timofeyeva chasha. First location on the bank of a hot spring.

Geographic distribution: cosmopolitan species.

##### Allolobophora parva Eisen, 1874

Occurrence. Bystraya R. (Khairyuzovaya R. basin).

Mature specimens noted on 2 September (1972).

Geographic distribution: cosmopolitan species.

---

<sup>1</sup>Species of Lumbricidae identified by T.S. Perel. We take this opportunity to thank her for her assistance.

Table 2. Species of Kamchatka and the Koryak upland

| Name of species                                              | Kam-<br>chatka | Koryak<br>upland | Chukchi<br>Peninsula |
|--------------------------------------------------------------|----------------|------------------|----------------------|
| <b>Fam. NAIDIDAE</b>                                         |                |                  |                      |
| <i>Stylaria lacustris</i> (Linnaeus)                         | +              | —                | —                    |
| <i>Slavina appendiculata</i> (d'Udekem)                      | +              | —                | —                    |
| <i>Vejdovskyella comata</i> (Vejdovsky)                      | +              | —                | —                    |
| <i>Nais communis</i> Piguet                                  | +              | —                | —                    |
| <i>N. variabilis</i> Piguet                                  | +              | —                | —                    |
| <i>N. simplex</i> Piguet                                     | —              | +                | —                    |
| <i>N. barbata</i> Müller                                     | +              | —                | —                    |
| <i>N. pardalis</i> Piguet                                    | +              | —                | —                    |
| <i>N. elinguis</i> Müller                                    | +              | —                | —                    |
| <i>N. borutzkii</i> Sokolskaja                               | +              | —                | —                    |
| <i>Specaria josinae</i> (Vejdovsky)                          | +              | —                | —                    |
| <i>Uncinails uncinata</i> (Ørsted)                           | +              | —                | —                    |
| <i>Homochaeta naidina</i> Bretscher                          | +              | —                | —                    |
| <i>Paranais birsteini</i> Sokolskaja                         | +              | +                | —                    |
| <i>Chaetogaster diaphanus</i> (Gruithuisen)                  | +              | +                | —                    |
| <b>Fam. TUBIFICIDAE</b>                                      |                |                  |                      |
| <i>Rhyacodrilus svetlovi</i> Sokolskaja                      | —              | +                | +                    |
| <i>Rh. coccineus</i> (Vejdovsky)                             | +              | +                | +                    |
| <i>Rh. levanidovae</i> Sokolskaja                            | +              | —                | —                    |
| <i>Bothrioneurum vejdoskjanum</i> Stole                      | +              | —                | —                    |
| <i>Tubifex hrabei</i> Sokolskaja                             | +              | +                | —                    |
| <i>T. kessleri americanus</i> Brinkhurst et Cook             | +              | —                | —                    |
| <i>Spirosperma</i> (E.) <i>kurenkovi</i> (Sokolskaja)        | +              | —                | —                    |
| <i>S. (O.) nikolskyi</i> (Lastochkin et Sokolskaja)          | +              | +                | —                    |
| <i>S. (S.) apapillatus</i> (Lastochkin et Sokolskaja)        | +              | +                | —                    |
| <i>Limnodrilus udekemianus</i> Claparède                     | +              | +                | —                    |
| <i>L. helveticus</i> Piguet                                  | +              | +                | —                    |
| <i>Ilyodrilus templetoni</i> (Southern)                      | +              | +                | —                    |
| <i>Ilyodriloides potatiensis</i> gen. et sp. n.              | —              | +                | —                    |
| <i>Alexandrovina ringulata</i> (Sokolskaja)                  | +              | +                | +                    |
| <b>Fam. ENCHYTRAETIDAE</b>                                   |                |                  |                      |
| <i>Propappus arhynchotus</i> Sokolskaja                      | +              | —                | —                    |
| <i>Mesenchytraeus</i> sp.                                    | +              | —                | —                    |
| <i>Lumbricillus kamtschatkanus</i> (Michaelsen)              | +              | —                | —                    |
| <b>Fam. LUMBRICULIDAE</b>                                    |                |                  |                      |
| <i>Lumbriculus variegatus</i> (Müller)                       | +              | —                | —                    |
| <i>Trichodrilus itchaensis</i> Sokolskaja                    | +              | +                | +                    |
| <i>Stylodrilus (Bythonomus) chukotensis</i> Sokolskaja       | —              | +                | +                    |
| <i>Rhynchelmoides malevichi</i> , sp. n.                     | —              | +                | —                    |
| <i>Styloscolex (Styloscolex) tetrathecus</i> Burrow          | —              | +                | —                    |
| <i>S. (S.) opisthothecus</i> Sokolskaja                      | +              | —                | —                    |
| <i>Styloscolex</i> (S.) sp.                                  | +              | —                | —                    |
| <b>Fam. KURENKOVIDAE</b>                                     |                |                  |                      |
| <i>Kurenkovia magna</i> Sokolskaja                           | +              | —                | —                    |
| <b>Fam. HAPLOTAXIDAE</b>                                     |                |                  |                      |
| <i>Haplotaxis gordioides</i> (Hartmann)?                     | +              | —                | +                    |
| <b>Fam. LUMBRICIDAE</b>                                      |                |                  |                      |
| <i>Eisenia nordenskiöldi</i> (Eisen)                         | +              | —                | —                    |
| <i>Dendrodrilus rubidus</i> Savigny v. <i>tenuis</i> (Eisen) | +              | —                | —                    |
| <i>Allolobophora parva</i> Eisen                             | +              | —                | —                    |

## II. Faunistic review

Table 2 contains our data on the discovery of oligochaete species in the water bodies of Kamchatka and the Koryak upland and their presence on the Chukchi Peninsula. The fauna of Kamchatka is the most abundant, which is apparently due not only to more thorough research of the peninsula, but also to its latitudinal location. (106)

More than one-half of the oligochaete species known in Kamchatka are made up of the geographically widely distributed ones, including the cosmopolitan species (Nais communis Fig., N. variabilis Fig., N. elinguis Müll., Limnodrilus udekemianus Clap.), species with ranges extending beyond the Holarctic Region (Slavina appendiculata (d'Udekem), Nais barbata Müll., N. pardalis Fig., Chaetogaster diaphanus (Gruith.), Rhyacodrilus coccineus (Vejd.), Lumbriculus variegatus (Müll.)), as well as holarctic and palearctic species. The group of holarctic species is made up of Stylaria lacustris (L.), Vejdovskyella comata (Vejd.), Specaria josiinae (Vejd.), Uncinais uncinata (Orsted), Ilyodrilus templetoni (South.) and Haplotaxis gordioides (Hartm.), while the palearctic group consists of only two species, Homochaeta naidina Bretsch. and Limnodrilus helveticus Fig.; we regard the second of the two as a palearctic species only conditionally (see systematic section of the paper).

Bothrioneurum vej dovskyanum Stolc. is apparently characterized by an extensive discontinuous range. It is currently known in Europe (common in some of the rivers of Czechoslovakia (Hrabe, 1934), the Danube R. basin (Finogenova, 1968), and has been noted in Swedish lakes (Milbrink, 1970). According to our data, the species inhabits the Primorsky krai. It is known in China (Chen, 1940), North America (states of Pennsylvania, Tennessee, Texas, California and Oregon, and in Canada on Vancouver Is. and in the Frazer R. (Brinkhurst, 1965, 1978), as well as in Africa (Brinkhurst, Jamieson, 1971). (107)

Despite the large number of common oligochaete species in the water bodies of Kamchatka, the frequency with which they are encountered in this area is as a rule insignificant<sup>1</sup>.

The exceptions are Rh. coccineus and H. gordioides which belong to the group of the most commonly encountered species on the peninsula (tables 3 and 4). In Kamchatka, the first is the most characteristic of lakes (frequency of occurrence 36%), and the second of rivers (50%). All the other wide-range species belong to the group with a low overall frequency of occurrence (5-15%); among these, L. variegatus was the most frequently encountered in rivers (20%). L. udekemianus and L. helveticus were less common, especially in the rivers. The second is more common than the first; it is also found in springs. Furthermore, it was encountered more frequently both in lakes (16%) and in rivers (10%) as compared with L. udekemianus (12 and 5% respectively). B. vej dovskyanum was found in the specific conditions of hot bath springs and warm mud in a volcano caldera, as well as in two lakes, but its numbers were the lowest (37 specimens).

Kamchatka is characterized not only by the infrequent occurrence of cosmopolitan species (L. udekemianus), but also by the absence of the highly common members of this group (Tubifex tubifex Mull.) and such commonplace holarctic oligochaete species as Spirosperma (S.) ferox Eisen. We have not encountered these species in the adjacent parts of the mainland either (Koryak upland, lower reaches of the Penzhina R. basin).

Naturally, the above species with extensive ranges do not determine the nature of the aquatic oligochaete fauna of Kamchatka. The other, more narrowly distributed species reveal the historical ties of the fauna of this region.

---

<sup>1</sup>The frequency of occurrence of Naididae and Lumbricidae is not analyzed, as they have been noted only in individual bodies of water.

Table 3. Finds of aquatic oligochaete species in different parts of Kamchatka

| Name of species                                         | Northern part |      | Central part |      | Southern part |      |
|---------------------------------------------------------|---------------|------|--------------|------|---------------|------|
|                                                         | west          | east | west         | east | west          | east |
| <i>Stylaria lacustris</i> (Linnaeus)                    | —             | —    | —            | +    | —             | —    |
| <i>Slavina appendiculata</i> (d'Udekem)                 | —             | —    | —            | +    | +             | —    |
| <i>Vejdovskyella comata</i> (Vejdovsky)                 | —             | +    | +            | —    | —             | —    |
| <i>Nais communis</i> Piguet                             | —             | —    | —            | —    | +             | —    |
| <i>N. variabilis</i> Piguet                             | —             | +    | —            | +    | +             | —    |
| <i>N. barbata</i> Müller                                | —             | —    | —            | +    | +             | —    |
| <i>N. pardalis</i> Piguet                               | —             | —    | —            | —    | —             | —    |
| <i>N. elinguis</i> Müller                               | —             | —    | —            | —    | +             | —    |
| <i>N. borutskii</i> Sokolskaja                          | —             | —    | —            | +    | —             | —    |
| <i>Specaria josinae</i> (Vejdovsky)                     | —             | —    | +            | —    | —             | —    |
| <i>Uncinatis uncinata</i> (Orsted)                      | —             | —    | +            | +    | —             | —    |
| <i>Homochaeta naidina</i> Bretscher                     | —             | —    | —            | —    | +             | —    |
| <i>Paranais birsteinii</i> Sokolskaja                   | —             | —    | —            | +    | —             | —    |
| <i>Chaetogaster diaphanus</i> (Gruithuisen)             | —             | —    | —            | +    | —             | —    |
| <i>Rhyacodrilus coccineus</i> (Vejdovsky)               | +             | —    | +            | +    | +             | +    |
| <i>Rh. levanidovae</i> Sokolskaja                       | —             | —    | —            | +    | —             | —    |
| <i>Bothrioneurum vejdoskjanum</i>                       | —             | —    | —            | —    | —             | —    |
| <b>Stolc</b>                                            | —             | —    | —            | +    | +             | —    |
| <i>Tubifex hrabei</i> Sokolskaja                        | —             | —    | —            | +    | +             | —    |
| <i>T. kessleri americanus</i> Brinkhurst et Cook        | —             | —    | —            | +    | +             | —    |
| <i>Spirosperma</i> (E.) <i>kurenkovi</i> (Sokolskaja)   | —             | —    | +            | +    | +             | —    |
| <i>S. (O.) nikolskyi</i> (Lastochkin et Sokolskaja)     | +             | —    | +            | —    | —             | —    |
| <i>S. (S.) apapillatus</i> (Lastochkin et Sokolskaja)   | —             | —    | —            | +    | +             | —    |
| <i>Limnodrilus udekemianus</i> Claparède                | —             | —    | —            | +    | +             | —    |
| <i>L. helveticus</i> Piguet                             | —             | —    | —            | +    | +             | —    |
| <i>Ilyodrilus templetoni</i> (Southern)                 | —             | —    | +            | +    | —             | —    |
| <i>Alexandrovina ringulata</i> (Sokolskaja)             | —             | +    | +            | +    | +             | —    |
| <i>Propappus arhynchotus</i> Sokolskaja                 | —             | —    | +            | +    | +             | —    |
| <i>Mesenchytraeus</i> sp.                               | —             | —    | —            | +    | +             | —    |
| <i>Lumbricillus kamtschatkanus</i> (Michaelsen)         | —             | —    | —            | —    | +             | —    |
| <i>Lumbriculus variegatus</i> (Müller)                  | —             | —    | —            | +    | +             | —    |
| <i>Trichodrilus itchaensis</i> Sokolskaja               | —             | —    | +            | —    | —             | —    |
| <i>Styloscolex</i> (S.) <i>opisthothecus</i> Sokolskaja | —             | —    | +            | +    | +             | —    |
| <i>Styloscolex</i> (S.) sp.                             | —             | —    | —            | —    | +             | —    |
| <i>Kurenkovia magna</i> Sokolskaja                      | —             | —    | —            | —    | +             | —    |
| <i>Haplotaxis gordioides</i> (Hartmann)?                | —             | —    | +            | +    | +             | +    |

Table 4. Frequency of occurrence of Oligochaeta species in the water bodies of Kamchatka\*

| Name of species                                               | Frequency of occurrence, % |                                    |       |                      |
|---------------------------------------------------------------|----------------------------|------------------------------------|-------|----------------------|
|                                                               | * overall                  | in water bodies of different types |       |                      |
|                                                               |                            | lakes                              | river | spring               |
| <i>Rhyacodrilus levanidovae</i> Sokolskaja                    | 2—5                        | 8                                  | —     | —                    |
| <i>Tubifex kessleri americanus</i> Brinkhurst et Cook         |                            | 4                                  | —     | —                    |
| <i>Spirosperma</i> (O.) <i>nikolskyi</i> (Last. et. Sokol.)   |                            | 4                                  | 16    | —                    |
| <i>Mesenchytraeus</i> sp.                                     |                            | 8                                  | 5     | —                    |
| <i>Trichodrilus itchaensis</i> Sokolskaja                     |                            | —                                  | 5     | —                    |
| <i>Kurenkovia magna</i> Sokolskaja                            |                            | —                                  | —     | 9                    |
| <i>Bothrioneurum vej dovskyanum</i> Stolz                     | 5—15                       | 8                                  | —     | только в теп-<br>лых |
| <i>Limnodrilus udekemianus</i> Claparède                      |                            | 12                                 | 5     | —                    |
| <i>L. helveticus</i> Piguet                                   |                            | 16                                 | 10    | 9                    |
| <i>Tubifex hrabei</i> Sokolskaja                              |                            | 8                                  | —     | 13                   |
| <i>Propappus arhynchotus</i> Sokolskaja                       |                            | 8                                  | 10    | 9                    |
| <i>Lumbriculus variegatus</i> (Müller)                        |                            | 16                                 | 20    | —                    |
| <i>Alexandrovina ringulata</i> (Sokolskaja)                   | 15—20                      | 8                                  | 20    | 36                   |
| <i>Spirosperma</i> (E.) <i>kurenkovi</i> (Sokolskaja)         |                            | 28                                 | 10    | —                    |
| <i>Rhyacodrilus coccineus</i> (Vejdovsky)                     | 20—30                      | 36                                 | 10    | 9                    |
| <i>Spirosperma</i> (S.) <i>apapillatus</i> (Last. et. Sokol.) |                            | 60                                 | 5     | —                    |
| <i>Styloscolex</i> (S.) <i>opisthothecus</i> Sokolskaja       |                            | 12                                 | 30    | 36                   |
| <i>Haplolaxis gordioides</i> (Hartmann)                       |                            | 8                                  | 50    | 27                   |

\*The table does not include data on the species of Maledidae and Lumbricidae, noted in individual bodies of water. Species grouped in ascending order of frequency of occurrence.

\*Overall frequency of occurrence - % of water bodies (of the number studied) in which species found. Frequency of occurrence in water bodies of different types - % of water bodies (of the number studied in a given type) where species noted.

These are two species with ranges confined to the Asian part of the Palearctic, which are typical of the Amur Basin but go beyond its boundaries, inhabiting the water bodies of the Paleoamur system (Southern Sakhalin), Kunashir Is., as well as the Koryak upland. One of these species, *Spirosperma* (O.) *nikolskyi* (Last. et Sok.), is distributed in the Amur basin from its sources to the Amur liman; the other species, *S.* (S.) *apapillatus* (Last. et Sok.), has a more eastern range confined to the middle and lower reaches of the Amur; it is not found on Kunashir Is. These species are opposites with regard to the frequency of occurrence in the water bodies of Kamchatka.

S.(O.) nikolskyi belongs to the group of the rarest species with an overall frequency of occurrence of 2-5%, and is apparently confined to the northern half of the peninsula and its western part; it is encountered more frequently in rivers (15%) than in lakes (4%). S.(S.) apapillatus is common in the central and southern parts of the peninsula, and belongs to the most common lake species with a maximum frequency of occurrence in lakes (60%). (110)

A significant role in the water bodies of Kamchatka is played by Alexandrovia ringulata (Sok.) (overall frequency of occurrence 15-20%) with a range covering the northern part of Eurasia and Northern Alaska. On the Kamchatka Peninsula, A. ringulata has been noted in the northern, southern and central parts, appearing mainly in springs (frequency of occurrence 36%) and rivers (20%), and rarely in lakes (8%).

The species which are so far known only in Kamchatka and in the water bodies of the Koryak upland consist of the naidid Paranaïs birsteini and the tubificid Tubifex hrabei, a species rarely encountered both in lakes (8%) and in springs (13%).

Trichodrilus itchaensis is currently known only in Kamchatka, the Koryak upland and the Chukchi Peninsula, but its importance in these regions is far from equivalent. The species is quite common in running waters on the Chukchi Peninsula. In the rivers running off the Koryak upland, it frequently forms large accumulations. On the Kamchatka Peninsula, only one specimen has been found in the Icha R.

The nearctic relations of the Kamchatka fauna of oligochaetes are clearly defined. In addition to A. ringulata, Kamchatka and North America have the species Styloscolex (S.) opisthothecus and the subspecies Tubifex kessleri americanus in common. The extensive Eurasian range of A. ringulata, together with its presence in only 7 lakes of Northern Alaska on the American continent

indicates that the species only recently found its way into the New World during one of the latest geological bridgings of the Asian and American continents.

S. opisthothecus, which is widely distributed in Kamchatka and has been noted in two lakes of Northern Alaska, is definitely of East Asian origin. It belongs to a genus with a range covering eastern Asia (Lake Baikal, NE China, Kamchatka, Koryak upland, Chukchi Peninsula, Hokkaido) and touching on America (Northern Alaska). The species is without a doubt genetically similar to S.(S.) tetrathecus (Sokol'skaya, 1978) which has the most extensive range in the genus Styloscolex (Lake Baikal, NE China, Koryak upland), also encountered rarely in unique bodies of water (Lake Baikal, Lake Potatgytkhyn). On the Kamchatka Peninsula, S. opisthothecus, one of the leading species of oligochaetes, is characteristic of springs (frequency of occurrence 36%), rivers (30%) and less commonly lakes (12%).

We cannot yet establish the origin and genetic relations of T. kessleri americanus also because we are not certain of the rank of the taxon (see systematic section of this paper). We can only say that it is common in the Great Lakes (Lake Superior and Lake Michigan), whereas it is extremely rare in Kamchatka (encountered in 4% of the lakes studied).

(111)

Among the species noted in Kamchatka, there is one typically brackish-water species, Nais borutzkii, which has also been found in the brackish waters of southern Sakhalin and is probably more widely distributed than is believed at the present time.

The results of our investigations of the aquatic oligochaetes of the Chukchi Peninsula (Sokol'skaya, 1975, 1976c) and the Koryak upland, as well as Holmquist's published data (Holmquist, 1974a, 1974c, 1976) on Alaska which had hardly been studied in the past for its aquatic oligochaetes prompt us to

review the previously discussed question regarding the endemic nature of the Kamchatka oligochaete fauna (Sokol'skaya, 1972a,b). The group of species regarded by us as conditionally endemic for Kamchatka decreased in size. A review of Peloscolex kamtschaticus (see systematic section of paper) permitted us to exclude this species from the list of endemic ones as well. The group of endemic oligochaetes of Kamchatka (we continue to refer to them as conditionally endemic species) includes 5 taxa, i.e. the monotypic family Kurenkovidae with one species Kurenkovia magna, two enchytraeid species Propappus arhynchotus and Lumbricillus kamtschatkanus, and two species of tubificids Rhyacodrilus levanidovae and Spirosperma (E.) kurenkovi.

We believe that the Kurenkovidae family described in this paper will be found beyond the boundaries of Kamchatka. An indication of this is the cryptic mode of life of its only member, which is probably associated with subterranean waters and requires special methods of collection.

The following can be said about the relationships of the other endemic species. P. arhynchotus is closer to the palearctic P. volki Mich. than to the Siberian P. glandulosus Mich. which is known from Lake Baikal and the Yenisei River. This closeness is based on the structure of the digestive tract (location of the mid-intestine, the presence of chloragogue tissue). P. arhynchotus is not very often encountered in Kamchatka, though it has been found in water bodies of different types, i.e. rivers (10%), springs (9%) and lakes (8%). In the opinion of Michaelsen who described it (1929), L. kamtschatkanus is similar to L. pagenstecheri (Ratzel) which is widely distributed in Europe. We cannot say what the frequency of occurrence of this species is in Kamchatka, as it was not identified among the specimens studied by us (see systematic section).

Despite its similarities to the European Rhyacodrilus falciformis Bretscher, Rh. levanidovae is distinguished from it by significant characteristics (Sokol'skaya, 1973a). This species is rarely encountered in Kamchatka, and has been found only in lakes (8%).

(112)

The relationships of S.(E.) kurenkovi were established only recently, after the description of S.(E.) alaskana and S.(E.) confusus in 1979 and a detailed study of the morphology, anatomy and histology of the Kamchatka species, undertaken by Holmquist (1979) in connection with a revision of the genus. It was established that the given species were definitely related (see systematic section of this paper). On the basis of Holmquist's study, we can say for certain that one of these species, S. (E.) confusus, is definitely found in the Great Lakes of North America. The second, Alaskan species has been noted only in 4 lakes (of the 100 studied in Alaska); two of them are located on the Seward Peninsula, and the other two south of Brooks Range inside Northern Alaska. The lakes on the Seward Peninsula (Imuruk and Kuzitrin) belong to the volcanic zone, and the first of these lakes occupies a basalt basin of Quaternary age (the second lake is at close distance from the first). It is in the first lake, extremely uniform in its fauna, that a colossal number of oligochaetes (up to 5,000 specimens per sample), mainly S. (E.) alaskana, has been found (Holmquist, 1979). The recent data on the discovery of S. (E.) alaskana, as well as its unquestionable closeness to S. (E.) kurenkovi, suggest that this is a young species and that its genesis may be related to the recent quaternary bridgings of the Asian and North American continents. On the Kamchatka Peninsula, S. (E.) kurenkovi is a widely distributed species, especially in lakes (28%).

The above data permit us to speak of the zoogeographic mosaic structure of the aquatic oligochaete fauna of Kamchatka. The nature of its endemic elements cannot always be evaluated at the present level of our knowledge of

the group as a whole (Kurenkovidae). On the other hand, there is no doubt about the European (Lubricillus kamtschatkanus) and North American (S. (E.) kurenkovi) relationship of the endemics.

The distribution of the different faunistic elements in the water bodies of Kamchatka points to the predominance of an E Asian, Kamchatka-American, endemic, northern Eurasian-American and only two widely distributed species. The leading components of the oligochaete fauna are ecologically highly dissociated, prevailing in water bodies of different types (lakes, rivers, springs).

At the present time, we still cannot give an extensive characterization of the oligochaete fauna of the Koryak upland, which has been studied considerably less than the Kamchatka fauna. So far, we know of 15 species from this area (see table 2). The common ones among them are Chaetogaster diaphanus (Holarctic and Sino-Indian regions), Nais simplex (Holarctic Region and Africa), Rhyacodrilus coccineus (Holarctic Region and Australia) and Lumnodrilus helveticus (Palearctic Region?). Here we note A. ringulata, which is characteristic of the water bodies of NE USSR, and both of the E Asian species of Spirosperma, S. (Embolocephalus) apapillatus and S. (Orientodrilus) nikolskyi; (113) also found here is Trichodrilus itchaensis which links Kamchatka, the Koryak upland and the Chukchi Peninsula, and is not known beyond their borders. The water bodies of the Koryak upland contain species common to the Chukchi Peninsula, but unknown in Kamchatka and the Anadyr R. basin, Stylodrilus (Bythonomus) chukotensis and Rhyacodrilus svetlovi. Finally, species found in Kamchatka and not anywhere else are noted in the Koryak upland as well (Paranais birsteini, Tubifex hrabei). Thus, faunistically, the Koryak upland appears to be a link, or a transitional zone between Kamchatka and the northern regions of the mainland.

Of significant interest is the discovery of Rhynchelmoides malevici, sp. n., a species similar to the Alaskan Rh. brooksi (Holmquist, 1976) in the structure of the male gonoduct and spermathecae, and belonging to the genus Rhynchelmoides Hrabe, which unites the North American [Rh. elrodi (Smith et Dickey), Rh. glandula (Altman)], Alaskan [Rh. alaskana (Holmquist), Rh. brooksi (Holmquist)], and apparently Japanese species [Rh. orientalis (Yamaguchi)].

Among the water bodies studied in the Koryak upland, the deep (over 100 m) and apparently old Lake Potatgytkhyn is a unique body of water. In addition to the above-mentioned widely distributed species and also A. ringulata and T. hrabei, a new species of a previously unknown genus, Ilyodriloides potatiensis, has been found in this lake. Only this lake in the Koryak upland has been found to contain what is probably the oldest species of Styloscolex, S. (S.) tetrathecus, which is known in three regions quite distant from each other (Baikal, NE China and the Koryak upland).

The nearctic relations of the oligochaetes of the Koryak upland are seen through A. ringulata (also found in Northern Alaska) and the lumbriculids S. (B.) chukotensis and Rh. malevici, which are closely related to the Alaskan species S. (B.) sovaliki Holmquist and Rh. brooksi (see above).

### III. Notes on the biology and ecology

The data on the ecology of the aquatic oligochaete species of Kamchatka are presented in the systematic section of this paper, where we give the depths, substrates and in some cases the temperatures and current velocities at the places the worms were found. The reproduction periods are also indicated. In this section of our paper, we shall discuss some of the general principles.

The periods of sexual reproduction of the Kamchatka Naididae (table 5), based on the presence of specimens with developed clitella, basically fit into the classic pattern typical of this family, i.e. reproduction begins at the end

of summer or in autumn; after copulation, the cocoons containing the eggs are deposited; they begin to develop in spring after the embryonal diapause (Svetlov, 1924). In S. lacustris and N. variabilis, mature worms were encountered at the beginning and in the middle of summer. Proceeding from the facts concerning these two species and having no data on other Kamchatka naidids, we assumed that the periods of sexual reproduction shifted in some of the species of Naididae under the conditions of Kamchatka (Sokol'skaya, 1972b). A study of all the material showed that the majority of the naidid species noted in Kamchatka reproduce sexually during the usual periods. (115)

P. birsteini from Lake Ushkovskoye was represented 85% by mature specimens on 29 September 1965, and all the specimens of N. barbata from Lake Kronotskoye were sexually mature on 3 October 1963, as were the specimens of Ch. diaphanus on 7 October 1963. In Lake Azabach'ye, almost all (97%) of U. uncinata were mature on 25 August 1965, and specimens with clitella constituted 88% on 6 October 1965. Therefore, there can be no talk of any general shift in the periods of sexual reproduction of the Naididae on the Kamchatka Peninsula, all the more since sexually mature specimens of Naididae have also been found in other regions from May up to November, according to the data of O.V. Chekanovskaya who refers to the data of Kieckebusch (1930). P.G. Svetlov (1924) came across sexually mature S. lacustris in the Perm region on 16 June 1924.

According to our data, the periods of sexual maturity in the Enchytraeidae on the Kamchatka Peninsula are brief (end of August and September). In many of the Tubificidae, this is particularly obvious in the species that are widely distributed and frequently encountered on the peninsula (A. ringulata, S. (E.) kurenkovi, S. (S.) apapillatus) in which the reproductive periods span several months (from May to October). They are even longer in L. helveticus,

as sexually mature worms begin to appear in April. Based on the example of T. hrabei, it has been noted that the worms found in springs become sexually mature sooner (in May-June) than those found in lakes (from July to October).

Table 5. Reproduction periods of aquatic Oligochaeta in Kamchatka waters

| Name of species                                         | Sexually mature specimens found on* |
|---------------------------------------------------------|-------------------------------------|
| <b>Fam. NAIDIDAE</b>                                    |                                     |
| <i>Stylaria lacustris</i> (Linnaeus)                    | 11.VI 1957 r.                       |
| <i>Nais variabilis</i> Piguet                           | 23.VII 1963 r.                      |
| <i>N. barbata</i> Müller                                | 3.X 1963 r.                         |
| <i>N. borutzkii</i> Sokolskaja                          | VIII 1959 r.                        |
| <i>Uncinais uncinata</i> (Ørsted)                       | 25.VIII — 7.IX                      |
| <i>Paranaïs birsteini</i> Sokolskaja                    | 29.IX 1965 r.                       |
| <i>Chaetogaster diaphanus</i> (Gruithuisen)             | 7.X 1963 r.                         |
| <b>Fam. TUBIFICIDAE</b>                                 |                                     |
| <i>Rhyacodrilus coccineus</i> (Vejdovsky)               | VI—IX                               |
| <i>Rh. levanidovae</i> Sokolskaja                       | III, VIII, XI 1965 r.               |
| <i>Tubifex hrabei</i> Sokolskaja                        | V, VI (in springs)                  |
| <i>T. kessleri americanus</i> Brinkhurst et Cook        | VII—X (lakes)                       |
| <i>Spirosperma</i> (E.) <i>kurenkovi</i> (Sokolskaja)   | From middle VII to 20.VIII          |
| <i>S. (O.) nikolskyi</i> (Lastochkin et Sokolskaja)     | From end V to X                     |
| <i>S. (S.) apapillatus</i> (Lastochkin et Sokolskaja)   | From end VII — to beginning VIII    |
| <i>Limnodrilus udekemianus</i> Claparède                | From VI to 10.X                     |
| <i>L. helveticus</i> Piguet                             | Middle of VII and middle of X       |
| <i>Alexandrovina ringulata</i> (Sokolskaja)             | from IV to X                        |
| <b>Fam. ENCHYTRAEIDAE</b>                               | (I), V, VI, VIII, IX                |
| <i>Propappus arhynchotus</i> Sokolskaja                 | 28.VIII & 25.IX                     |
| <i>Lumbricillus kamtschatkanus</i> (Michaelsen)         | 22.IX 1909 r.                       |
| <b>Fam. LUMBRICULIDAE</b>                               |                                     |
| <i>Lumbriculus variegatus</i> (Müller)                  | 16.VI 1909 r.                       |
| <i>Trichodrilus itchaensis</i> Sokolskaja               | 21.III 1960 r.                      |
| <i>Styloscolex</i> (S.) <i>opisthothecus</i> Sokolskaja | from II to VIII                     |
| <i>Styloscolex</i> (S.) sp.                             | 12.IV 1959 r.                       |
| <b>Fam. KURENKOVIDAE</b>                                |                                     |
| <i>Kurenkovia magna</i> Sokolskaja                      | II, V & X                           |

S. opisthothecus, a very common species in Kamchatka and characteristic mainly of springs and rivers, shows a significant shift in reproductive periods in winter, i.e. it reproduces over a period of seven months, beginning in February and ending in August. K. magna, which has been found only in the spring tributary of the Bol'shaya R. (in the Karymai) also begins to breed in February.

\*Months in Roman numerals. If year not indicated, data are for several years.

Table 6. Depth of occurrence of Naididae in the lakes of Kamchatka

| Name of species                             | Name of lake                                                | Depth, m        |
|---------------------------------------------|-------------------------------------------------------------|-----------------|
| <u>Stylaria lacustris</u> (Linnaeus)        | Small lake in delta of Listvennichnaya R.                   | 0.5             |
| <u>Slavina appendiculata</u> (D'Udekem)     | Lake Kronotskoye, Zaliv Unana                               | 0.5             |
| <u>Nais communis</u> Piguet                 | Lake Kuril'skoye                                            | 50-60           |
| <u>N. pardalis</u> Piguet                   | Lake Ushkovskoye                                            | 0.5             |
| <u>N. barbata</u> Müller                    | Lake Ushkovskoye<br>Lake Kronotskoye, Zaliv Unana           | 0.5             |
| <u>Specaria josinae</u> (Vejdovsky)         | Lake Kronotskoye, Uzon and Krodakyg bays                    | 9-15            |
| <u>Uncinais uncinata</u> (Orsted)           | Lake Azabach'ye<br>Lake Kronotskoye, Uzon and Krodakyg bays | 0.7-1.0<br>9-15 |
| <u>Homochaeta naidina</u> Bretscher         | Lake Kuril'skoye                                            | 50-60           |
| <u>Chaetogaster diaphanus</u> (Gruithuisen) | Lake Kronotskoye, Krodakyg Bay                              | 9.5             |

In the Tubificidae species that are much scarcer on the Kamchatka Peninsula than the ones mentioned above, e.g. Rh. levanidovae and L. udekemianus, as well as in K. magna, mature specimens have been noted by us during different seasons with intervals of 2-4 months (March, August and September; July and October). We believe that in these cases the studied material enabled us to establish only certain parts of a continuous process similar to the one discussed above. The data on T. itchaensis (a single occurrence) are insufficient for revealing specific tendencies. However, we should note that sexually mature specimens of this species were noted from the end of July (21st) up to September 6th on the Chukchi Peninsula (our data), at the beginning of August 1972 in the water bodies of the Koryak upland, and at the end of March on the Kamchatka Peninsula. L. variegatus is known as a species which rarely reproduces sexually in any region. (116

Of the ecological characteristics of the Kamchatka oligochaetes, we should mention the fact that certain species of naidids have found their way into the deeper parts of lakes, species which in the central zone of the European part of the USSR are confined to the littoral zone (N. communis, U. uncinata, H. naidina, Ch. diaphanus). However, the depth at which these species are encountered in the lakes of Kamchatka (table 6) is far from the maximum depths indicated for these species in the lakes of central Europe (Ude, 1929; Kieckebusch, 1930). According to these authors, N. communis in the lakes of Switzerland has been noted at a depth of over 100 m, S. josinae at 28 m, U. uncinata up to 50 m, and Ch. diaphanus 135 m.

#### References

1. Burov V.S. Oligochaetes of the Lake Baikal region (Pribaikal'ye) II. Three new species of Styloscolex in Lake Baikal. Transactions of the Biological-Geographic Research Institute of Irkutsk University, 1931, v. 5, No. 4.
2. Hrabe S.A. Oligochaetes of Lake Onega based on the 1930-1932 collections of B.M. Aleksandrov. Spisy prirod. fak. Univ. J.E. Purkyne. Brno, 1962, No. 435.
3. Zaloznyi N.A. The fauna of aquatic oligochaetes and leeches of Western Siberia. IN: Problems of Ecology. Tomsk, 1976, v. 4.
4. Izosimov V.V. Oligochaetes of the family Lumbriculidae. Proceedings of the Limnological Institute of the Siberian Department of the USSR Academy of Sciences, 1962, v. 1 (21), part 1.
5. Kurenkov I.I. List of aquatic invertebrates of the inland waters of Kamchatka. Izv. TINRO, 1967, v. 57.
6. Lastochkin D.A., Sokol'skaya N.L. New species of oligochaetes of the genus Peloscolex (family Tubificidae) from the Amur Basin. Zool. zhurnal, 1953, v. 32, No. 3.
7. Morev A.P. On the oligochaete fauna of the central Anadyr R. IN: Biological Problems of the North, Sixth symposium, No. 2, 1974. Yakutsk.
8. Morev A.P. Data on the oligochaete fauna of the central Anadyr R. IN: Hydrobiological Investigations of the Inland Waters of NE USSR. Vladivostok, 1975.
9. Morev A.P. Styloscolex sokolskajae, sp. n. (Oligochaeta, Lumbriculidae) from the waters of NE USSR. Zool. zhurnal, 1978, v. 57, No. 8.

10. Poddubnaya T.L. On the systematics of Chaetogaster diaphanus (Gruith.) (Oligochaeta, Naididae). Trudy In-ta biol. vnutr. vod AN SSSR, 1966, No. 12 (5).
11. Svetlov P.G. Observations on the Oligochaeta of the Perm Gubernia. On the fauna and ecology of the family Aeolosomatidae and Naididae. Transactions of the Biological Research Institute and Biological Station of Perm State University, 1924, v. 3, No. 5.
12. Sokol'skaya N.L. Freshwater oligochaetes of the Amur Basin. Proceedings of the Amur Ichthyological Expedition of 1945-1949, 1957, v. 4.
13. Sokol'skaya N.L. Data on the freshwater oligochaete fauna of Kamchatka. Byul. MOIP, otd. biol., 1961, v. 66 (1).
14. Sokol'skaya N.L. Data on the aquatic oligochaete fauna of Southern Sakhalin. IN: Lakes of Southern Sakhalin and Their Ichthyofauna. Moscow, Moscow University Publishing House, 1964a.
15. Sokol'skaya N.L. A new species and subspecies of the family Naididae (Oligochaeta) from the brackish waters of Kamchatka and Southern Sakhalin. Byul. MOIP, otd. biol., 1964b, v. 69 (4).
16. Sokol'skaya N.L. On the fauna of aquatic Oligochaeta of the Far East of the USSR. Biol. nauki, 1968a, No. 6.
17. Sokol'skaya N.L. Cases of displacement of the reproductive system in Rhyacodrilus coccineus (Vejdovsky) and the questions regarding the existence of the species Rhyacodrilus riabuschinskii Michaelsen (Oligochaeta, Tubificidae). Zool. zhurnal, 1968b, v. 47, No. 2.
18. Sokol'skaya N.L. New species of Lumbriculidae (Oligochaeta) from Kamchatka. Zool. zhurnal, 1969, v. 48, No. 3.
19. Sokol'skaya N.L. A new species of the genus Paranais (Oligochaeta, Naididae) from Kamchatka. Zool. zhurnal, 1971, v. 50, No. 6.
20. Sokol'skaya N.L. New data on the fauna of aquatic Oligochaeta of Kamchatka. IN: Aquatic Oligochaeta. Data of the 2nd All-Union Symposium, Borok, 27-30 June 1972, Yaroslavl, 1972a.
21. Sokol'skaya N.L. New data on the fauna of aquatic Oligochaeta of Kamchatka. Trudy Zool. muzeya MGU, v. 12, Moscow, 1972b.
22. Sokol'skaya N.L. New species of Tubificidae from Kamchatka and new finds of oligochaetes in the water bodies of the peninsula. Byul. MOIP, otd. biol., 1973a, v. 78 (5).
23. Sokol'skaya N.L. A new species of Trichodrilus (Oligochaeta, Lumbriculidae) from Kamchatka. Zool. zhurnal, 1973b, v. 52, No. 11.

24. Sokol'skaya N.L. A new species of Stylodrilus (Oligochaeta, Lumbriculidae) from the Chukchi Peninsula. Zool. zhurnal, 1975, v. 54, No. 1.

25. Sokol'skaya N. L. Data on the fauna of Lumbriculidae (Oligochaeta) of the Chukchi Peninsula. Byul. MOIP, otd. biol., 1976a, v. 81 (3).

26. Sokol'skaya N.L. Rhyacodrilus svetlovi, sp. n. (Oligochaeta, Tubificidae) from the waters of the Chukchi Peninsula. Zool. zhurnal, 1976b, v. 55, No. 7.

27. Sokol'skaya N.L. Data on the oligochaeta fauna encountered in the water bodies of the Chukchi Peninsula. IN: Freshwater Fauna of the Chukchi Peninsula. Vladivostok, 1976c.

28. Sokol'skaya N.L. Species of the genus Styloscolex Michaelsen, 1901 of the Far East of the USSR. Trudy Zool. muzeya MGU. Moscow, 1978, v. 16.

29. Chekanovskaya O.V. Aquatic Oligochaetes of the USSR Fauna. Key to the Fauna of the USSR. Leningrad, 1962, v. 78.

30. Chekanovskaya O.V. Oligochaetes of Karelian lakes. IN: Fauna of Karelian Lakes. Invertebrates. Moscow, Leningrad, "Nauka" Publishers, 1965.

31. Chekanovskaya O.V. Present state of the systematics of aquatic oligochaetes (family Tubificidae). IN: Aquatic Oligochaeta. Trudy Vses. gidrobiol. ob-va, 1972, v. 17.

32. Finogenova N.P. Oligochaetes of the Soviet sector of the Danube and adjacent water bodies. Zool. zhurnal, 1968, v. 48, No. 7.

33. Hrabe S. The Oligochaeta from Lake Okhrida and Lake Prespa. Zool. J. Syst., 1931, v. 61, No. 1/2.

34. Hrabe S.O. Asexual reproduction in Bothrioneurum vej-  
dovskyanum Stolc. Sbor. klubu prirod. Brno, 1934, No. 17.

35. Hrabe S.O. On Dorydrilus (Piguettia) mirabilis n. subgen., n. sp. from a well in the vicinity of Basle and on Dorydrilus (Dorydrilus) michaelseni Pig. and Buichaeta sanguinea Bretsch.

36. Hrabe S.O. Key to the fauna of the Czechoslovak S.R. Oligochaeta, part I. IN: Ces. Akad. VED, Praha, 1954.

37. Hrabe S.O. Two new species of the genus Rhynchelmis from Slovakia. Publ. Fac. Sci, Univ. J.E. Purkyne, Brno, 1961, No. 421.

38. Michaelsen W. Oligochaeta from the 1908-1909 Kamchatka Expedition. Yezhegodnik Zool. muzeya AN SSSR, 1929.

- 1 Буров В. С. Малошетниковые черви Прибайкалья II. Три новых вида *Styloscolex* на озере Байкал. — Изв. биол.-геогр. НИИ при Иркутском университете, 1931, т. 5, вып. 4.
- 2 Грабье С. А. Олигохеты Онежского озера по сборам Б. М. Александрова в 1930—32 гг. — *Spisy prirod. fak. Univ. J. E. Purkyně, Brno*, 1962, № 435.
- 3 Залозный Н. А. Фауна водных олигохет и пиявок Западной Сибири. — В кн.: Проблемы экологии. Томск, 1976, т. 4.
- 4 Изосимов В. В. Малошетниковые черви семейства Lumbriculidae. — Труды имнолог. ин-та Сибирского отд. АН СССР, 1962, т. 1 (21), ч. 1.
- 5 Куренков И. И. Список водных беспозвоночных внутренних водоемов Камчатки. — Изв. Тихоокеан. НИИ рыбн. хоз. и океанографии (ТИНРО), 1967, т. 57.
- 6 Ласточкин Д. А., Сокольская Н. Л. Новые виды олигохет рода *Peloscoclex* (сем. Tubificidae) из бассейна Амура. — Зоол. журн., 1953, т. 32, вып. 3.
- 7 Морев А. П. О фауне олигохет среднего течения реки Анадырь. — В кн.: Биол. пробл. Севера. VI Симпозиум, вып. 2. Якутск, 1974.
- 8 Морев А. П. Материалы по фауне олигохет среднего течения р. Анадырь. — В кн.: Гидробиол. исслед. внутр. водоем. Сев.-Вост. СССР. Владивосток, 1975.
- 9 Морев А. П. *Styloscolex sokolskajae*, sp. n. (Oligochaeta, (Lumbriculidae) из водоемов Северо-Востока СССР. — Зоол. журн., 1978, т. 57, вып. 8.
- 10 Поддубная Т. Л. К систематике *Chaetogaster diaphanus* (Gruiht.) (Oligochaeta, Naididae). — Труды Ин-та биол. внутр. вод АН СССР, 1966, вып. 12(15).
- 11 Светлов П. Г. Наблюдения над Oligochaeta Пермской губернии П. К фауне и экологии сем. Aeolosomatidae и Naididae. — Изв. биол. НИИ и биол. станции при Пермском гос. университете, 1924, т. 3, вып. 5.
- 12 Сокольская Н. Л. Пресноводные малошетниковые черви бассейна Амура. — Труды Амур. ихтиол. эксп. 1945—1949 гг., 1957, т. 4.
- 13 Сокольская Н. Л. Материалы по фауне пресноводных малошетниковых червей Камчатки. — Бюл. МОИП, отд. биол., 1961, т. 66(1).
- 14 Сокольская Н. Л. Материалы по фауне водных малошетниковых червей Южного Сахалина. — В кн.: Озера Южного Сахалина и их ихтиофауна. М., Изд-во Моск. ун-та, 1964а.
- 15 Сокольская Н. Л. Новые вид и подвид сем. Naididae (Oligochaeta) из солоноватых вод Камчатки и Южного Сахалина. — Бюл. МОИП, отд. биол., 1964б, т. 69(4).
- 16 Сокольская Н. Л. К фауне водных Oligochaeta Дальнего Востока СССР. — Биол. науки, 1968а, № 6.
- 17 Сокольская Н. Л. Случай сдвига в положении половой системы у *Rhyacodrilus coccineus* (Vejdovsky) и вопрос о существовании вида *Rhyacodrilus riabuschinskii* Michaelsen (Oligochaeta, Tubificidae). — Зоол. журн., 1968б, т. 47, вып. 2.
- 18 Сокольская Н. Л. Новые виды Lumbriculidae (Oligochaeta) с Камчатки. — Зоол. журн., 1969, т. 48, вып. 3.
- 19 Сокольская Н. Л. Новый вид рода *Paranais* (Oligochaeta, Naididae) с Камчатки. — Зоол. журн., 1971, т. 50, вып. 6.
- 20 Сокольская Н. Л. Новые данные о фауне водных Oligochaeta Камчатки. — В кн.: Водные малошетниковые черви. Мат-лы 2-го Всес. симпозиума, Борок 27—30 июня 1972 г. Ярославль, 1972а.
- 21 Сокольская Н. Л. Новые материалы по фауне водных Oligochaeta Камчатки. — Труды Зоол. музея МГУ, т. 12. М., 1972б.
- 22 Сокольская Н. Л. Новые виды Tubificidae с Камчатки и новые находения олигохет в водоемах полуострова. — Бюл. МОИП, отд. биол., 1973а, т. 78(5).
- 23 Сокольская Н. Л. Новый вид *Trichodrilus* (Oligochaeta, Lumbriculidae) с Камчатки. — Зоол. журн., 1973б, т. 52, вып. 11.
- 24 Сокольская Н. Л. Новый вид *Stylodrilus* (Oligochaeta, Lumbriculidae) с Чукотского полуострова. — Зоол. журн., 1975, т. 54, вып. 1.
- 25 Сокольская Н. Л. Материалы по фауне Lumbriculidae (Oligochaeta) Чукотского полуострова. — Бюл. МОИП, отд. биол., 1976а, т. 81(3).
- 26 Сокольская Н. Л. *Rhyacodrilus svetlovi*, sp. n. (Oligochaeta, Tubificidae) из водоемов Чукотского п-ова. — Зоол. журн., 1976б, т. 55, вып. 7.

- 27 Сокольская Н. Л. Материалы по фауне малошетниковых червей (Oligochaeta) водоемов Чукотского полуострова. — В кн.: Пресновод. фауна Чукотского п-ова. Владивосток, 1976в.
- 28 Сокольская Н. Л. Виды рода *Styloscolex* Michaelsen, 1901 Дальнего Востока СССР. — Труды Зоол. музея МГУ. М., 1978, т. 16.
- 29 Чекановская О. В. Водные малошетниковые черви фауны СССР. — Определитель по фауне СССР. Л., 1962, т. 78.
- 30 Чекановская О. В. Малошетниковые черви озер Карелии. — В кн.: Фауна озер Карелии. Беспозвоночные. М.: Л.; Наука, 1965.
- 31 Чекановская О. В. Современное состояние систематики водных олигохет (сем. Tubificidae). — В кн.: Водные малошетниковые черви. — Труды Всес. гидробиол. об-ва, 1972, т. 17.
- 32 Финногенова Н. П. Малошетниковые черви Советского участка Дунай и придунайских водоемов. — Зоол. журн., 1968, т. 48, вып. 7.
- 33 Altman L. C. Oligochaeta of Washington. (Univ. Wash. Publ. Biol., 1936, vol. 4, N 1).
- 34 Brinkhurst R. O. Studies on the North American aquatic Oligochaeta II: Tubificidae. — Proc. Acad. Nat. Sci. Philadelphia, 1965, vol. 117, N 4.
- 35 Brinkhurst R. O. Freshwater Oligochaeta in Canada. — Canad. J. Zool., 1978, vol. 56, N 10.
- 36 Brinkhurst R. O. and Jamieson B. G. M. Aquatic Oligochaeta of the world. — Univ. Toronto press, 1971.
- 37 Chen I. Taxonomy and faunal relations of the limnetic Oligochaeta of China. — Contr. Biol. Labor. Sci. Soc. China, Zool. Ser., 1940, vol. 14.
- 38 Hrabě S. Die Oligochaeten aus den Seen Ochrida und Prespa. — Zool. J. Syst., 1931, Bd 61, H. 1/2.
- 39 Hrabě S. O nepohlavním rozmnožování nitěnků *Bothrioneurum vej-douskyanum* Stoll. Sbor. klubu přírod. Brno, 1934, ročn. 17.
- 40 Hrabě S. Über *Dorydrilus* (Piguetia) mirabilis n. subgen., n. sp. aus einem Sodbrunnen in der Umgebung von Basel sowie über *Dorydrilus* (*Dorydrilus*) *michaelseni* Pig. und *Bichaeta sanguinea* Bretsch. — Spisy Přírod. Fak. Masarykovy Univ., 1936, N 227.
- 41 Hrabě S. Količ zvěřeny C. S. R. Oligochaeta, díl. I. — In.: Čes. Akad. VED. Praha, 1954.
- 42 Hrabě S. Dva nové druhy rodu *Rhynchelmis* ze Slovenska. — Publ. Fac. Sci. Univ. J. E. Purkyně, Brno, 1961, N 421.
- 43 Hrabě S. On *Rhyacodrilus lindbergi* n. sp., a new cavernicolous species on the family Tubificidae (Oligochaeta) from Portugal. — Bol. Soc. Portug. Ciênc. Nat., 1963, vol. 10.
- 44 Hrabě S. On *Peloscolex svirenkoi* (Jarošenko) and some other species of the genus *Peloscolex*. — Publ. Fac. Sci. Univ. J. E. Purkyně, Brno, 1964, N 450.
- 45 Hrabě S. New or insufficiently known species of the family Tubificidae. — Publ. Fac. Sci. Univ. J. E. Purkyně, Brno, 1966, N 470.
- 46 Hrabě S. Two new species of the family Tubificidae from the Black Sea, with remarks about various species of the subfamily Tubificinae. — Publ. Fac. Sci. Univ. J. E. Purkyně, Brno, 1967, N 485.
- 47 Holmquist Ch. On *Alexandrovina onegensis* Hrabě from Alaska, with a revision of the Telmatodrilinae (Oligochaeta, Tubificidae). — Zool. J. Syst., 1974a, Bd 101.
- 48 Holmquist Ch. A species of *Styloscolex* Michaelsen (Oligochaeta, Lubriculidae) found in two lakes in Northern Alaska. — Int. Rev. ges. Hydrobiol., 1974b, vol. 59, N 1.
- 49 Holmquist Ch. Lumbriculids Oligochaeta of Northern Alaska and Northwestern Canada. — Zool. J. Syst., 1976, Bd 103.
- 50 Holmquist Ch. Revision of the genus *Peloscolex* (Oligochaeta Tubificidae) 1. Morphological and anatomical scrutiny, with discussion on the generic level. — Zool. Scripta, 1978, vol. 7.
- 51 Holmquist Ch. Revision of the genus *Peloscolex* (Oligochaeta Tubificidae) 2. Scrutiny of the species. — Zool. Scripta, 1979, (Соколь-).
- 52 Kieckebusch S. T. Tabulae biologicae. Ed. W. Junk, 1930, b.
- 53 Michaelsen W. Oligochaeten der Kamtschatka-Expedition 1909. — Ежегодн. Зоол. музея АН СССР, 1929.
- 54 Milbrink G. Records of Tubificidae (Oligochaeta) from the great lakes (L. Mälaren, L. Vättern, L. Vänern) of Sweden. — Arch. Hydrobiol., 1970, N 1.
- 55 Nielsen C. O., Christensen B. The Enchytraeidae. Critical revision and taxonomy of European species. — Natura Jutlandica, 1959, vol. 8—9.
- 56 Southern R. Contributions towards a Monograph of the British and Irish Oligochaeta. — Proc. Roy. Irish Acad., 1909, vol. 27, Sect. B, N 8.
- 57 Sperber Ch. A taxonomical study of the Naididae. — Zool. Bidrag från Uppsala, 1948, Bd 28.
- 58 Sperber Ch. A guide for determination of European Naididae. — Zool. Bidrag från Uppsala, 1950, Bd 29.
- 59 Yamaguchi H. Studies on the aquatic Oligochaeta of Japan. I. Lumbriculids from Hokkaido. — J. Fac. Sci. Hokkaido Imp. Univ., Ser. VI, Zool., 1936, t. 5, N 1.